

Государственное образовательное учреждение  
высшего профессионального образования  
**«Томский государственный университет  
систем управления и радиоэлектроники»**

## **ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 12-2/1**

**“Nano Technology”  
(«Нанотехнологии»)**

Публикации в трудах конференций

**Источник:** *Digital Library IEEEExplore*

**Язык:** *английский*

**Глубина поиска:** *2009 – 2011 гг.*

**Дата формирования:** *март 2011 г.*

**Составитель:** *В.И. Карнышев*

**Томск – 2011**



## ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 12-2/1

### "Nano Technology"

#### («Нанотехнологии»)

Публикации в трудах конференций

#### "Complex nonlinear opto-fluidics: Controlling flow with light and vice-versa"

We demonstrate symbiotic dynamics of light and nano-particles suspended in liquid. Light-force varies the local particle density, modifies the fluid properties (surface-tension, viscosity), inducing flow patterns in the fluid, causing synergetic nonlinear-dynamics of light and fluid. [C1]

#### "Variation-Aware TED-Based Approach for Nano-CMOS RTL Leakage Optimization"

As technology scales down to nanometer regime the process variations have profound effect on circuit characteristics. Meeting timing and power constraints under such process variations in nano-CMOS circuit design is increasingly difficult. This causes a shifting from worst-case based analysis and optimization to statistical or probability based analysis and optimization at every level of circuit abstraction. This paper presents a TED (Taylor Expansion Diagram) based -multi-Toxtechniques during high-level synthesis (HLS). A variation-aware simultaneous scheduling and resource binding algorithm is proposed which maximizes the power yield under timing yield and performance constraint. For this purpose, a-multi-Toxlibrary is characterized under process variation. The delay and power distribution of different functional units are exhaustively studied. The proposed variation-aware algorithm uses those components for generating low power RTL under a given timing yield and performance constraint. The experimental results show significant improvement as high as 95% on leakage power yield under given constraints. [C2]

#### "Electron beam direct drawing on living cell"

This paper reports a novel nanofabrication method for living cell. Our method provided both nano deposition and ablation on a living cell in nanoscale resolution. This paper shows nanostructures fabrication using this electron beam (EB) induced deposition, and also reports cell response for EB direct drawing. Conventional onsite processes for the live cells were reported as femto second laser induced process in micro scale resolution. Our process has nanoscale resolution because of using focused electron beam. We proposed our method for live cell processible nanofabrication to analyze protein scale dynamic reaction on cell system. [C3]

#### "Variation-aware logic mapping for crossbar nano-architectures"

Programmable nano-architectures fabricated based on bottom-up self-assembly process are alternative for CMOS technology to overcome physical barriers as well as increased lithography-based fabrication costs in downscaling. Extreme process variation and high failure rate due to nondeterministic self assembly fabrication process pose serious challenges for logic implementation in this technology. In this paper, we analyze the effect of variations on mapped designs and propose an efficient mapping method to reduce variation effects on crossbar nano-architectures. This method takes advantage of reconfigurability and abundance of resources for tolerating variation and improving reliability. The main idea is based on duplicating crossbar input lines as well as swapping rows (columns) of a crossbar to reduce the output dependency and be able to reduce delay variation. Experimental results on a set of benchmarks show that the proposed method can reduce critical path delay up to 74% (57% in average). [C4]

#### "Keynote: DNA-based molecular devices"

We overview recent work in the field of DNA-based autonomous biomolecular devices. We particularly emphasize molecular assemblies and molecular devices that are (i) self-assembled: that is they assemble into DNA nanostructures in one stage without explicit external control, (ii) programmable: the tasks the molecular devices execute can be modified without an entire redesign and (iii) autonomous: they operate without external mediation (e.g. thermal-cycling). We describe recent experimental progress in DNA-based autonomous biomolecular devices that achieve: 2D patterning, computation, amplified sensing, and molecular nano-scale transport. These have taken the technology from a state of intriguing possibilities into demonstrated capabilities of quickly increasing scale, and we describe a number of very promising applications in the biomedical industry.



[C5]

#### **"Plasmonic low pass filter by nano rods embedded in metal-insulator-metal waveguides"**

Since introducing plasmonic material, lots of efforts have been made to design and fabricate metallic optical structures by Ag and Au. These structures are used to overcome previous limitations such as guiding optical waves below the diffraction limit. A variety of plasmonic waveguides such as V-grooves, wedges, gaps, ring resonators, micro-cavities, etc as a part of these structures have been investigated in previous works. [C6]

#### **"Nano-level 3-D shape measurement system using 3-wavelength LED light interference fringes"**

Nano-level 3-D measurement is one of the key technologies for the current and next generation of production systems for semi-conductors, LCDs and nano-devices. To meet with these applications, "Wide range nano-level 3-D shape measurement method using combination of RGB laser lights" has been developed. It measures the height of nano-objects from the combination of RGB LED lights combinations. To analyze the combination of RGB lights, the color analysis method on xy-color plane has been introduced. In this method, the color changes on xy-color plane means the height changes. Experimental system to measure the micro-meter heights using RGB lightings has been developed, and succeeded to measure the 50 nm step and 500 nm step samples. [C7]

#### **"A novel three-dimensional micro supercapacitor using self-support nano composite materials"**

This paper reports a novel silicon three-dimensional (3D) micro supercapacitor, featured by a high-aspect-ratio structure and nano porous composite electrode material. Electrochemical characterization results of the prototype with  $\text{NaNO}_3$  electrolyte demonstrate that the 3D supercapacitor exhibits both large capacitance ( $90.7 \text{ mF/cm}^2$ ) and fast power delivery ( $51.5 \text{ mW/cm}^2$ ) per unit area. A very robust stability and high charge/discharge efficiencies (more than 93%) are also observed. As such, it is believed that this work presents a promising approach to achieve micro supercapacitors that are applicable in various energy systems such as micro power suppliers and energy storage devices. [C8]

#### **"Energy-efficient biotelemetry system with Nano IP"**

Technical advancements in embedded systems, wireless communications and physiological sensing allow small size, light weight, ultra low power, and intelligent monitoring devices. A number of these devices can be integrated into energy efficient biotelemetry system with Nano IP, a new enabling technology for health monitoring, sports and military applications. The sensing unit which is wearable device consists of sensors and integrated circuits. These devices are capable of performing health monitoring activities such as heart rate, breath rate, blood glucose, body temperature and nerve stimulus with a personal computer and then monitored parameters can be send to necessary place through Nano IP communication protocol suit. An energy-efficient implementation of Wireless Body Sensor Networks (WBSNs) with embedded technology is designed featured with Work-on-Demand protocol. Dedicated for ultra-low-power wireless sensor nodes, the system consist of a low power Microcontroller unit (MCU), a Power Management Unit (PMU), reconfigurable sensor interfaces and communication ports controlling a wireless transceiver with GSM technology. The MCU, together with the PMU, provides quite flexible communication and power-control modes for energy efficient operations. This system will consumes less amount of power than its existing models, which is less than 3.3 volts. The measured parameters are interfaced with mobile devices through nano IP technology [C9]

#### **"Novel conductive polymer micro-spring contact array for large area woven electronic textile"**

This work reports three innovations in flexible device technology; the use of micro-spring array as the electrical contact components in e-textile, the novel spring cantilever releasing method using air injection and the results of patternable CYTOP and organic conductive polymer using nanoimprinting method. Microspring contact array is realized to compose the electrical circuit through the large area woven textile. The contact resistance of  $480 \Omega$  is hold on for over 500 times. [C10]

#### **"Functionalized mesoporous thin-film directly self-assembled on resonant-cantilevers for batch-producible chemical sensors"**

The paper reports a top-down/bottom-up combined resonant micro-cantilever chemical sensor, where functionalized mesoporous thin-film (MTF) is directly self-assembled on the sensing region of the integrated cantilever. By using the batch-producible nano construction technique, a large number of such sensors can be volume fabricated with uniform performance among individual sensors or different runs. More importantly, sensing groups can be simultaneously constructed at the pore inner surface when the MTF is directly constructed on the cantilever. With  $-\text{NH}_2$  groups modified, the functionalized MTF is grown onto the surface of



the cantilever free-end, the micro-gravimetric sensor exhibits quick response and high-sensitive detection to gaseous CO<sub>2</sub>. [C11]

#### "Modeling the Effect of Gate Fringing and Dopant Redistribution on the Inverse Narrow Width Effect of Narrow Channel Shallow Trench Isolated MOSFETs"

This paper presents an analytical physics-based model for width dependence of threshold voltage of nano-scale MOSFETs. Shallow trench isolated MOSFETs have been considered in the 90 nm and 65 nm technology nodes. The combined effect of gate fringing field and dopant redistribution has been considered for developing the model. The trench oxide parasitic capacitance is evaluated by conformal mapping technique and is then used to determine the width-dependent threshold voltage shift. The developed model has been validated by comparing the results predicted from the derived model with experimental data, simulation data and also with a similar model available in literature. It has been demonstrated that our model predicts more correctly the inverse narrow width effect on threshold voltage of nano-scale devices compared to the existing model. [C12]

#### "Removal of Indoor Pollutants by Nano TiO<sub>2</sub>/beta-Cyclodextrin Coated Paper under UV Irradiation"

As one of the typical indoor pollutants, formaldehyde has attracted more and more attention. It is well known that long-term exposure to even fairly low levels of formaldehyde will bring the risk of asthma, eczema and other diseases. In this study, the nano-TiO<sub>2</sub>/β-cyclodextrin (β-CD) coated paper was applied to remove formaldehyde under UV irradiation. The optimum composition of the nano-TiO<sub>2</sub>/β-CD coated on paper was studied in detail with regard to the efficiency of formaldehyde removal. The results showed that gaseous formaldehyde can be removed by the nano-TiO<sub>2</sub>/β-CD coated paper with different efficiencies depending upon the different ratios of nano-TiO<sub>2</sub> and β-CD in the paint. After 6 h of irradiation, formaldehyde was removed completely by the coated papers with nano-TiO<sub>2</sub> and β-CD ratio of 1 to 3. The coated papers could decompose formaldehyde repeatedly after regeneration. This kind of nano-TiO<sub>2</sub>/β-CD coated paper could be used as air-cleaning materials such as wallpaper to remove various pollutants indoor. [C13]

#### "Preparation of Doped Nano-TiO<sub>2</sub> by Sol-Gel Method and the study on Its Photocatalytic Performance"

The paper produces Nano-TiO<sub>2</sub> doped with Fe<sup>3+</sup>, Ce<sup>3+</sup>, Cu<sup>2+</sup>, Ce<sup>3+</sup> and La<sup>3+</sup> using sol-gel method, examines the effects of their preparation condition on catalyst performance, and then explores the influence of the adding amount of metal ions and different ions combinations on photocatalytic activity of modified Nano-TiO<sub>2</sub>. The result indicates the optimum condition for preparing doped Nano-TiO<sub>2</sub> adopting sol-gel method as following. Firstly, at the temperature of 20°C, add 2 ml of nitric acid into the testing solution with 1 hour stirring at speed of 200 r/min; secondly, deposit the solution for 5 hours; and then calcinate above precipitate for 2 hours at the temperature of 500°C. The final product is Nano-TiO<sub>2</sub> prepared by sol-gel method. In addition, the comparisons of the effects of single-group ion doped product and double-group ones show that Nano-TiO<sub>2</sub> doped with Cr<sup>3+</sup> (2.2wt%), La<sup>3+</sup> (0.5wt %) and Fe<sup>3+</sup> (0.2wt %) possesses the strongest photocatalytic activity. [C14]

#### "Statistical analysis of SRAM parametric failure under supply voltage scaling"

Increased process variations in nano-scaled technologies lead to parametric failures in embedded SRAMs. The reduction of the supply voltage in order to ensure low leakage power leads to a decrease in robustness. These are the main factors which affect the failure probability and so the circuit yield. A widely used technique to determine the failure probability is the full Monte Carlo simulation. However, in order to achieve high accuracy, the number of simulations must be extremely large making this procedure very expensive time wise. In this paper, a method for fast and accurate estimation of the failure probability is proposed. The method can be applied with a set of performance or response functions, and throughout this paper the Static Noise Margin metric is used. [C15]

#### "Robust H<sup>∞</sup> control of a scanning tunneling microscope under parametric uncertainties"

This paper is devoted to the control system design for high performance scanning tunneling microscope (STM). A common approach by scanning probe community is to use conventional proportional integral (PI) control design to control the vertical movement of STM tip (z-direction). In this article, a modern H<sup>∞</sup> control design is analyzed in order to obtain the dual purpose of ultrahigh positioning accuracy with high bandwidth. Uncertainty model, based on experimental analysis of tunneling characteristics and parametric description of the STM, and norm-bounded real perturbations are considered, and an H<sup>∞</sup> controller is designed by following the desired control objectives. A performance and robustness analysis is finally performed to test robust stability and performance of STM. [C16]



### "Quantitative strain analysis for advanced CMOS technology by Nano Beam Diffraction"

Nano Beam Diffraction has been used to analyze the local strain distribution in MOS transistors. The influence of wafer process on the channel strain has been systematically analyzed in this paper. The source/drain implantation can cause a little strain loss but the silicidation step is the key process in which dramatic strain loss has been found. [C17]

### "Dynamics and control of a biomimetic single-wing nano air vehicle"

This paper describes the Samarai-a rotating mono-wing nano air vehicle (NAV) designed at Lockheed Martin Advanced Technology Laboratories. Challenges uniquely associated with developing this type of vehicle are identified and a dynamic modeling and control synthesis procedure is described for tackling them. It is shown that, by modeling the rotating wing as a lower-complexity spinning disk, and using the disk states for feedback control, a very simple control design results. This approach is validated in simulation of flight maneuvers that include vertical, hovering and translational motion segments. [C18]

### "Learning Proteomic Network Structure by a New Hill Climbing Algorithm"

As a progressive, degenerative disease, ataxia telangiectasia (A-T) is caused by a gene mutation (ATM) and is a predisposition to cancer. Understanding the impaired signaling networks caused by ATM will help minimizing the damage and finding effective therapies. The goal of this work is to investigate the dynamic change of ATM-dependent signaling pathways under the treatment of different radiation dosages. A reverse-phase protein microarray (RPPM) in conjunction with quantum dots nano-crystal technology is used for the quantitative measurement. To discover the proteomic pathways affected in ATM cells, a new hill climbing algorithm is developed based on mutual information, the classical hill-climbing method, and the optimization of the local structure. More trusted biology networks are thus defined by the new approach. The study was carried out at different time points under different dosages for cell lines with and without ATM mutation. To validate the performance of the proposed algorithm, comparison experiments were also implemented using public networks. [C19]

### "Study of size effect on the conductivity of nano-silver colloids"

Two nano-silver particles, 22 nm and 120 nm, were prepared by the polyol method where silver nitride was as the silver source and polyvinylpyrrolidone (PVP) was added to prevent the as-synthesized nanoparticles from agglomeration. After that, the particles in the colloid form were coated separately, where photo paper was the substrate. It is found that the resistances of the two coatings are strongly depending on the particle sizes. Through heating process, the 22 nm silver coating shows excellent conductivity which the sheet resistance can decrease to  $0.39 \Omega/\square$  when it was heating for 10 min, 200 °C. Meanwhile, the 120 nm silver coating showed high resistance. UV-vis spectrum was used to characteristic the nano Ag colloids, the resistivity variation and microstructure of the Ag coating were using a four-point probe and scanning electron microscopy (SEM). The good conductivity of the 22 nm Ag colloid coating shows us a bright future which can be used as the conductive ink of printing electronics. [C20]

### "Five-beam Interference Pattern Model for laser interference lithography"

Laser interference lithography (LIL) is an established fabrication technology for micro and nano scale structuring of periodic and quasi-periodic surface patterns. This paper presents a Five-beam Interference Pattern Model for laser interference lithography. It can be programmed to obtain images of interference results showing interference intensity distributions. The majority of 2-5 beam interference patterns can be simulated by this model with every variable in an LIL system. In this work, different technologies for nano structuring are introduced, along with the principle of the five-beam interference pattern model. Several images of interference results obtained by the five-beam interference pattern model are shown and some of their possible applications are discussed. Three-beam interference patterns and five-beam interference patterns are formed using a laser beam that goes along the z axis which is not used commonly in other LIL models. [C21]

### "Algorithm-based fault tolerance for many-core architectures"

Modern many-core architectures with hundreds of cores provide a high computational potential. This makes them particularly interesting for scientific high-performance computing and simulation technology. Like all nano scaled semiconductor devices, many-core processors are prone to reliability harming factors like variations and soft errors. One way to improve the reliability of such systems is software-based hardware fault tolerance. Here, the software is able to detect and correct errors introduced by the hardware. In this work, we propose a software-based approach to improve the reliability of matrix operations on many-core processors. These operations are



key components in many scientific applications. [C22]

### "NanoV: Nanowire-based VLSI design"

In the coming decade, CMOS technology is expected to approach its scaling limitations. Among the proposed nanotechnologies, nanowires have the edge in the size of circuits and logic arrays that have already been fabricated and experimentally evaluated. For this technology, logic-level design methodologies are being developed. The time has now come to develop automated tools for implementing VLSI designs using nanowires. In this paper, we discuss a design automation tool, called Nano V, to fulfill this need for nanowires. It is a complete logic-to-layout tool with built-in defect-aware steps since the defect levels in nanotechnologies are expected to be relatively high (between 1 to 10%). We are unaware of any other such comprehensive VLSI design tool for nanowires. We report area/delay/power results for various benchmarks implemented using our tool. We intend to make the tool available on the web. [C23]

### "UNION: A unified inter/intra-chip optical network for chip multiprocessors"

As modern computing systems become increasingly complex, communication efficiency among and inside chips has become as important as the computation speeds of individual processor cores. Traditionally, inter-chip and intra-chip communication architectures are separately designed to maximize design flexibility under different constraints. However, jointly designing communication architectures for both inter-chip and intra-chip communication could potentially yield better solutions. In this paper, we present a unified inter/intra-chip optical network, called UNION, for chip multiprocessors (CMP). UNION is based on recent progress in nano-photonics technologies. It connects not only processors on a single CMP but also multiple CMPs in a system. UNION employs a hierarchical optical network to separate inter-chip communication traffic from intra-chip communication traffic. It fully utilizes a single optical network to transmit both payload packets and control packets. The network controller on each CMP not only manages intra-chip communications but also collaborate with each other to facilitate inter-chip communications. We compared CMPs using UNION with those using a matched electronic counterpart in 45 nm process. Based on eight applications, simulation results show that on average UNION improves CMP performance by 3.1X while reducing 92% of network energy consumption and 52% of communication delay. [C24]

### "Synthesis of cubic-GaN nanoparticles using the Na flux method: A novel use for the ultra-high pressure apparatus"

Nano-scale cubic-GaN particles were successfully synthesized using the Na flux method under about 500 atm with a belt-type ultra-high pressure apparatus. High pressure nitrogen gas of about 500 atm was sealed in the ultra-high pressure apparatus, which enabled the dissolution of pressurized nitrogen gas into a Ga-Na melt at 500°C without a compressor. In contrast, the conventional Na flux method is carried out under a pressure of 150 atm, the maximum pressure of a nitrogen gas cylinder. A characteristic feature of the process used herein is that the high-pressure reaction gas is dissolved into a flux within the ultra-high pressure apparatus. The c-GaN nanoparticles obtained by this method show excellent crystallinity and a low mixing ratio of hexagonal-GaN, and thus the method solves two common problems in the synthesis of c-GaN. [C25]

### "Toluene Removal Using Non-Thermal Plasma Technology Coupled with Nano-Ba<sub>0.8</sub>Sr<sub>0.2</sub>Zr<sub>0.1</sub>Ti<sub>0.9</sub>O<sub>3</sub>"

A series of experiments were performed to remove toluene from a gaseous influent at normal temperature and atmospheric pressure by non-thermal plasma generated dielectric barrier discharge coupled with nano-Ba<sub>0.8</sub>Sr<sub>0.2</sub>Zr<sub>0.1</sub>Ti<sub>0.9</sub>O<sub>3</sub> catalyst. We were innovative to prepare nano-Ba<sub>0.8</sub>Sr<sub>0.2</sub>Zr<sub>0.1</sub>Ti<sub>0.9</sub>O<sub>3</sub> catalyst by ourselves and use it in the plasma reactor. The best removal efficiency of toluene arrives at 95% in condition of toluene concentration of 600 mg/m<sup>3</sup>, flow rate of 1 mL/min and electric field strength of 14 kV/cm. Nano-Ba<sub>0.8</sub>Sr<sub>0.2</sub>Zr<sub>0.1</sub>Ti<sub>0.9</sub>O<sub>3</sub> not only resulted in greater enhancement of toluene removal efficiency and reducing energy efficacy on treating with the same quantity of toluene, but also controlled byproducts effectively in plasma process. [C26]

### "Regulating beyond nanotechnology do nano-specific problems require nano-specific solutions?"

As has been the case with many new technologies, the introduction of nanotechnology creates the potential for positive as well as negative implications for health, the environment and society. The possibility of new technological capabilities also reveals gaps and uncertainties in existing regulatory structures. But while problems arising with new technologies tend to be described in technological terms (for example, we might speak of nano-hazards and nano-divides), responding exclusively in technological terms may not be helpful in the longer term.



Solutions to technological elements of a broader problem are distorting and laws drafted in technological terms tend to become obsolete as the technology concerned continues to evolve. This paper considers means by which technologies such as nanotechnology can be subjected to appropriate regulation in a way that remains effective in the face of ongoing technological developments. [C27]

#### "Recent advances in micro-structured electric and nano-structured magnetic microwave metamaterials"

Some recent advances in wire-type micro-structured electric metamaterials and nano-structured magnetic metamaterials are presented. It is shown that both exhibit rich macroscopic properties leading to novel microwave concepts and devices. The micro and nano scales may be combined in multi-scale metamaterials with unprecedented functionalities. [C28]

#### "Overview: Emerging technologies on giga-scale FPGA implementat"

FPGA is an efficient reconfigurable IC platform and is playing an increasingly important role in the electronics prototype implementation. With the rapid development of semiconductor technology and nano-technology over the last decade, FPGA has entered into a Giga-scale era. In this paper, the current status and future directions of Giga-scale FPGAs are presented. Specifically, the emerging technology-based FPGAs such as asynchronous FPGA, 3-dimensional FPGA, memristor-based nanoFPGA, and embedding-module FPGA, are discussed to solve the current FPGA challenges of timing constringency, signal integrity and power issues. This survey article aims to provide a guideline to future FPGA development. [C29]

#### "Configurable MCPW based inductor for mm-wave circuits and systems"

High quality factor configurable inductors are critical components for robust multiband wireless applications. Configurable Multilayer Coplanar Wave Guide (MCPW) based inductors in nano-scale CMOS technologies are proposed in this paper for millimeter wave frequency applications. Inductors are tweaked by adjusting the transmission line length to compensate for process variations of the mm-wave circuits and cover multiple bands. For demonstration, a mm-wave Voltage Controlled Oscillator (VCO) using the configurable inductor was designed and fabricated. Measurement reveals that the VCO covers frequency ranging from 72.8 to 77.6 GHz with phase noise of -109 dBc/Hz at 10 MHz offset, which is in good agreement with the MCPW-based inductor model prediction. [C30]

#### "Effectofsamarium dopant on photocatalytic activity of TiO2 nano-particle for the degradation of reactive orange 4"

TiO<sub>2</sub> is an ideal material for catalytic technology due to its unique properties. In this paper, the effect of Sm<sup>3+</sup> dopant on the photocatalytic activity of TiO<sub>2</sub> was studied to improve the catalytic efficiency of TiO<sub>2</sub>. The Sm<sup>3+</sup>-TiO<sub>2</sub> photocatalyst was made from Titanium Tetrabutoxide and Samarium Oxide with the Sol-Gel process and used to degrade reactive orange 4 (RO<sub>4</sub>) in Azo Dyes. The characteristics of the catalyst was analyzed with XRD and TEM. The experimental results show that the catalyst has high activity for the degradation of Azo Dyes. The intensity of characteristic peaks of RO<sub>4</sub> at both 489 nm and 285 nm weakens as the increase in the catalytic time. The Azo bonds of RO<sub>4</sub> are more active, so that they are easily broken by oxidation. The catalytic activity of the Sm<sup>3+</sup> doped catalyst greatly depends on the pH of solution. The catalyst has higher photocatalytic activity at both neutral and alkaline conditions. The degradation mechanism of the Sm<sup>3+</sup> doped TiO<sub>2</sub> photo-catalyst was also analyzed. [C31]

#### "Robust low power design in nano-CMOS technologies"

Increasing variability in nano-CMOS technologies poses a major challenge for low power design. Conventional design methods add large safety margins to mitigate variability that incur high power/ performance loss. We present a sensor based design methodology that minimizes pessimistic margin, while still providing reliable circuit operation. Variation resilient sensors are embedded in our design to detect minimum supply voltage that allows low power error free operation. HSPICE simulations indicate a 42% reduction in the average power consumption under temperature variations. [C32]

#### "All-digital frequency and clock synthesis architectures from a signals and systems perspective, current state and future directions"

Modern nano-scale CMOS technologies favor all-digital architectures for frequency synthesizers in wireless and other mixed-signal applications. This paper is a short introduction to the topic presenting contemporary approaches from a signal and systems perspective as well as directions for future research. [C33]



### **"A formal specification of fault-tolerance in prospecting asteroid mission with Reactive Autonomie Systems Framework"**

The NASA's Autonomous Nano Technology Swarm (ANTS) is a generic mission architecture consisting of miniaturized, autonomous, self-similar, reconfigurable, and addressable components forming structures. The Prospecting Asteroid Mission (PAM) is one of ANTS applications for survey of large dynamic populations. In this paper, we propose a formal approach based on Category Theory to specify the fault-tolerance property in PAM by Reactive Autonomie Systems Framework. [C34]

### **"Design of a CNFET array for sensing and control in P450 based biochips for multiple drug detection"**

Bio-detection specially dedicated to distributed diagnostics is emerging as a quite important application for Nano-bioelectronics. Bio-detection is required to be highly sensitive in order to succeed in sensing small amount of bio-markers in patient's blood sample. Carbon Nanotubes (CNTs) provides devices in the scale of the target molecules, thereby opening up possibilities to sense few bio-markers. Moreover, bio-detection is also required to be highly specific in order to succeed in disease discrimination. FET technology provides control in multi-panel biochip to enhance specificity. The aim of the present paper is to design an array of Carbon Nanotube Field Effect Transistors (CNFETs) to provide nano-biosensing based on cytochromes P450. In particular, a novel CNFET biosensor array design is proposed which is robust to the imperfections in the CNTs thereby achieving high level of sensitivity. The proposed CNFET based design assures the improved specificity by means of a multi-gate controller at the nano-scale. The proposed application in distributed diagnostics is on detection of drugs in multi-components samples by multiplexing different P450 probes. [C35]

### **"On scalable spiking convnet hardware for cortex-like visual sensory processing systems"**

This paper summarizes how Convolutional Neural Networks (ConvNets) can be implemented in hardware using Spiking neural network Address-Event-Representation (AER) technology, for sophisticated pattern and object recognition tasks operating at mili second delay throughputs. Although such hardware would require hundreds of individual convolutional modules and thus is presently not yet available, we discuss methods and technologies for implementing it in the near future. On the other hand, we provide precise behavioral simulations of large scale spiking AER convolutional hardware and evaluate its performance, by using performance figures of already available AER convolution chips fed with real sensory data obtained from physically available AER motion retina chips. We provide simulation results of systems trained for people recognition, showing recognition delays of a few milliseconds from stimulus onset. ConvNets show good up scaling behavior and possibilities for being implemented efficiently with new nano scale hybrid CMOS/nonCMOS technologies. [C36]

### **"Protein grafting onto chitosan surafce using low temperature microwave plasma treatment"**

Protein chips are useful tools for profiling proteins and analyzing protein-protein interactions and post-translational modifications. To treat the surfaces of polymer and proteins, low temperature plasma treatment is an effective technique<sup>1,2</sup>. In order to form miro or nano arrays on protein chips, the techniques for patterned modification of substrate surfaces are important. In this study, proteins or chemicals are covalently immobilized on the plasma treated surface of the polysaccharide such as chitosan to produce a high density protein chip. The free amino group of chitosan reacts with an aldehyde to give the corresponding Schiff base. The effects and mechanism of surface modification using low temperature plasma were investigated. [C37]

### **"Analysis of SOA-based middleware service layers for polynary resources SoC"**

As manufacturing process technology enter into nano-phase, integrate billions of transistors on a single chip has become a reality. By combining pre-designed and configurable SoCs as complementary and independent resources, a new concept of embedded HPC system named as PRSoC was proposed. HPC architectures, MPI parallel programming specification, IPC mechanism of multi-core / multiprocessor system, the application and protocol of network-area concepts, principles of SOA and web service management middleware were introduced to the SoC design area. Asymmetric one-way write-only chip serial bus architecture for the PRSoC model was presented. The middleware service layer of PRSoC based on SOA was analyzed thoroughly. [C38]

### **"Absorbed-specimen current imaging implementation and characterization in nano-prober for resistive interconnects isolation in 45-nm silicon-on-insulator microprocessors"**

Absorbed-specimen current imaging forms an image based on the electron current signal absorbed by the



specimen when the primary electron beam scans across the specimen in the scanning electron microscopy (SEM). This method combined is mainly used to localize resistive or open contact/via sites in a multi-layer silicon-on-insulator (SOI) microprocessor chip. The major benefit of absorbed-current imaging is the isolation of buried interconnect defects beneath the surface layer. We successfully implemented absorbed-current imaging in a nano-prober system and performed detailed characterization of parameters influencing the absorbed current. The absorbed-specimen current imaging method is validated using intentionally shorted interconnects. [C39]

#### **"Physical failure analysis cases by Electron Beam Absorbed Current & Electron Beam Induced Current detection on nano-probing SEM system"**

As the device feature size smaller and circuit complexity increase rapidly, failure analysis techniques to isolate defects will become more difficult and challenging. In this work, The new technique which combine EBAC/EBIC and nano-probing in a SEM system is presented. We study the new technique for failure site location and report two FA cases. One is 70 nm gate oxide thinner by AEI model and another is 65 nm device damaged by two probes VDIC model. We conclude that this technology provides us an effective alternative solution for semiconductor failure analysis. [C40]

#### **"Six-DOF maglev nano precision microstage development"**

Nanometer precision micromotion stage is a critical instrument for nanotechnology and is widely applied in semiconductor lithography and modern microfabrication machines. This paper focuses on the latest development of six-degree-of-freedom (six-DOF) magnetic levitation nanometer precision microstage and its actuating and bearing technology. Compared with the traditional stage, the maglev microstage has simple structure and better dynamic performance. As without friction, deformation and vibration problems, the six-DOF maglev microstage will be further applied and explored in nanometer precision motion systems. [C41]

#### **"Research on the rheological characteristics of layered nano-montmorillonite modified asphalt binder"**

The requirements for modified bitumen are increasing according to the higher load condition and worse serving environment in modern highway construction. And with the development of nano-technology in material design, it is found that polymer modifier combined with layer silicate can obviously improve the using properties. Nanometer montmorillonite (MMT) modified asphalt concrete is a kind of composite which can enhance the performances of asphalt pavement by using some MMT materials. An exfoliated structure was formed in MMT modified bitumen through a physical and chemical process and the physical capabilities of bitumen was improve evidently. The rheological characteristics of MMT modified asphalt bind are study using Dynamic Shear Rheometer (DSR) in this research which including Frequency Sweep and Temperature Sweep. The effects of MMT concentration, temperature and loading frequency on the viscosity, complex shear modulus and phase angle of MMT modified asphalt binder are investigated. The origin binder and the layered nanometer MMT content of 1 wt%, 3 wt%, 5 wt% were tested. The rheological properties of layer nanometer MMT modified asphalt was improved significantly. [C42]

#### **"Research on nano mechanical properties and ultra-structure of yeast cells"**

Cellular mechanics is a hot field of biological mechanics and biological engineering. The development of the Nano-indentation technique provides a new way for examining the nano-mechanical characteristics of the yeast cells. The nano-indentation properties and the ultra-structure of yeast cells were examined by using the Tribo Indenter in nano-mechanical test Instrument. The largest indentation depth was much less than 10 percent of the diameter of yeast cells, which was measured by the atomic force microscope (AFM). The indentation pit was gradually deepened with the increase of applied loads. The variation amplitudes of nano-hardness and elastic modulus changed with the applied load. The hardness of M22-2 was greater than M22-2/h VDAC at first, whereas it was less than the later one with the increased indentation depth. When yeast cells were on monocrystalline silicon wafer, the elastic modulus of M22-2 was towards an approximate constant of about 0.3854GPa. The elastic modulus of M22-2 was less than that of M-3 at the beginning and was larger than that of M-3 when the indentation depth was larger than 237nm as the elastic modulus of M-3 decreased. The hardness of M22-2 was gradually decreased with the increased indentation depth. The hardness of M-3 was bigger than that of M22-2 at first, whereas was less than that of the latter with the increased indentation depth. The results show that VDAC played an important role on cell function and elasticity of the M22-2 yeast strain supplemented with a human VDAC1 gene better than VDAC1-deficient yeast strain, and also elasticity of the M22-2 yeast better than M-3 yeast strain. The elasticity of the yeast cells on monocrystalline silicon wafer and was better than that on cover glass. By repetitive tests and analyses, the mechanical properties of yeast cells and the load they can sustain were obtained. The experiment proved the feasibility of nano-mechanics property



research of yeast cells with the aid of the Tribo Indente--r. Nano-indentation technology not only provides useful information for cell physiology and pathology processes, but also brings a new method for the precise quantitative analysis of cell function which is helpful in the surface bionic engineering. [C43]

#### "Development of the supported nickel-based catalysts and application in pyrolyzing biomass"

The supported nano-NiO/ $\gamma$ -Al<sub>2</sub>O<sub>3</sub> catalyst was prepared by deposition-precipitation (DP) method. Different analytical approaches such as XRD, BET, TEM and SEM/EDX were used to characterize the synthesized catalysts. The results showed that the prepared nano-NiO/ $\gamma$ -Al<sub>2</sub>O<sub>3</sub> catalysts had a coated structure with a loading of NiO in catalysts over 12 wt %, and they had also a high BET surface area of 124.6 m<sup>2</sup>/g. The active components of catalyst were spherical NiO nanoparticles coated on the surface of supports with a size range of 12~18 nm. Meantime, the activity of the catalysts to remove tar in the process of biomass pyrolysis was also investigated using a bench-scale combined fixed bed reactor. The experiments demonstrated that the tar yield after adding catalysts was reduced significantly, and the removal efficiency of tar reached to 99% for catalytic pyrolysis at 800°C, while the gas yield after adding catalysis increased markedly. Meanwhile, the compositions of gas products before and after adding catalysts in the process also changed significantly, especially the percentages of H<sub>2</sub> and CO in the product gas after adding catalysts were obviously increased. Therefore, the prepared catalysts showed their excellent catalytic activity for tar removal and syn-gas production in biomass pyrolysis. [C44]

#### "Conformal deposition of electroless barrier and seed layers in TSV with Au nano particle catalyst"

Low cost and low temperature fabrication process is required for TSV. In this study, we propose a low temperature deposition of barrier and copper seed layers by wet process only using electroless plating. Moreover, we use AuNPs as a catalyst which is densely adsorbed on SiO<sub>2</sub> sidewall of TSV with SAM. We succeeded in conformal deposition of barrier and seed layers, and this method is effective for realizing a low resistance Cu-filled TSV. [C45]

#### "What can be observed from surface plasmon spectral interference?"

A far-field experiment was presented to observe the SPP spectral interference and reveal the SPP contribution in the interaction between the nano-objects, and directly address the key issue of a debate raised in Nature Physics. [C46]

#### "Advances in thermal interface technology: mono-metal interconnect formation, processing and characterisation"

As the demand for new thermal technologies and materials has been increasing over the years to provide thermal solutions to the next generation of power electronics, microprocessors and high-power optical systems also thermal characterisation methods have to keep up with the pace of this development with respect to resolution and accuracy. We have developed both bulk and interface technologies to reduce thermal resistance using Ag and Au-based materials and low-T and low-p processes to render them eligible for the electronics industry. New processes to generate nano-enhanced surface structures as well as thermo-compression bonding are examined within this paper. Along with these processes especially designed test stands are described which are able to extract the effects achieved by the technological advances. [C47]

#### "Nano-coupling and enhancement in plasmonic conical needle"

Efficient coupling and power concentration of radially-polarized light in conical plasmonic needle is presented. Needle length dependent resonances are calculated. Radial plasmonic DBR with needle as defect was fabricated for NSOM and nonlinear conversion experiments. [C48]

#### "Emitter of continuous-wave, ultra coherent, extreme ultraviolet radiation that is driven by low-power laser"

We propose emitter of high-order harmonics that is driven by a low-power continuous-wave laser. The driving field is enhanced within a micro-resonator and further focused into sub-wavelength hot-spots by plasmonic nanoparticles that are located near its surface. [C49]

#### "Ground bounce noise reduction of low leakage 1-bit nano-CMOS based full adder cells for mobile applications"

As technology scales into the nanometer regime ground bounce noise and noise immunity are becoming



important metric of comparable importance to leakage current, active power, delay and area for the analysis and design of complex arithmetic logic circuits. In this paper, low leakage 1bit full adder cells are proposed for mobile applications with low ground bounce noise and a novel technique has been introduced with improved staggered phase damping technique for further reduction in the peak of ground bounce noise. Noise immunity has been carefully considered since the significant threshold current of the low threshold voltage transition becomes more susceptible to noise. We introduced a new transistor resizing approach for 1bit full adder cells to determine the optimal sleep transistor size which reduce the leakage power and ground bounce noise. The simulation results depicts that the proposed design also leads to efficient 1bit full adder cells in terms of standby leakage power, active power, ground bounce noise and noise margin. We have performed simulations using Cadence Spectre 90nm standard CMOS technology at room temperature with supply voltage of 1V. [C50]

#### "7.1: TWT and X-Ray devices based on carbon nano-tubes"

Field emission cathodes using carbon nano-tubes (CNT) are considered for various vacuum devices in the future. We present a TWT for satellite systems and an X-ray device using CNTs cathodes. Both devices have been designed and tested at breadboard level as a first step to demonstrate the benefits resulting from this new cathode. [C51]

#### "Design of a Multi-mission Satellite Ground Station for Education and Research"

Satellite space missions need ground stations for mission control and data communication. In this paper we present a modular ground station, which will be used for nano and pico satellites. The frequency bands initially supported are VHF, UHF, and S-band around 145 MHz, 435 MHz, and 2.3 GHz, respectively. We present a flexible, layered approach, which is ideally suited for multiple missions and allows for the addition of further frequency bands and missions. Furthermore, it allows seamless inclusion of the ground station in ground station networks. The ground station is designed for research as well as education and training of students. [C52]

#### "Novel circuit technique for reduction of active drain current in series/parallel PMOS transistors stack"

Stacking of MOS transistors is used for minimization of standby current in Nano-scale CMOS circuits. Stacking of PMOS is preferred over NMOS because value of active drain current in PMOS is less than NMOS. It results because of mobility of holes in PMOS is less than mobility of electrons in NMOS. In this paper we observed active drain current consumption by series/parallel combination of two and three PMOS transistors. This observation leads to propose the novel technique for reduction of active drain current in series/parallel PMOS assembly. The effect of VGS, VDS, VSB and intermediates node voltages is also addressed. The proposed circuit is simulated for TSMC 0.18  $\mu\text{m}$  technology using Spice© simulator. [C53]

#### "Piezoresistive cantilever for mechanical force sensors"

This paper describes piezoresistive cantilever force sensors that are used to evaluate the impact force between microhandling tools and microparticles in the nano-Newton range. The 500 nm-thick piezoresistive sensors are made from epitaxial silicon on single crystal silicon. This cantilever is based on conventional silicon wafers and fabricated using bulk micromachining. The cantilevers are 300-500  $\mu\text{m}$  long, 10-20  $\mu\text{m}$  high, and 10-18  $\mu\text{m}$  wide. The applied force on this sensor is parallel to wafer surface. This structure can eliminate the effect of the vertical force, increasing the sensitivity and accuracy of the system. The force sensitivity of implemented sensors ranges from 150 to 300 V/N. The force resolution estimated at 6 nN. [C54]

#### "Mid-infrared single-photon detection using superconducting nanowires integrated with nano-antennae"

We present some major challenges of mid-infrared superconducting nanowire single-photon detector technology and our device design with nano-antenna integration to address these challenges. [C55]

#### "Ternary TIMeX2 compounds for MEMS application"

Results of ab initio simulation of electronic and magnetic properties of TIMeX2 compounds (Me=Ga, In, Tl; X=S, Se, Te) under the of strain deformation influence are presented. It was confirmed theoretically the experimental data about prominent anisotropy of various physical properties of these compounds, i.e. about perspective of investigated nano-structured objects as a materials for using in various nano-devices, in particular, in sensor and micro-electro-mechanical systems. [C56]



### "Development an ontology of Microelectromechanical Systems (MEMS) and nano-electromechanical systems (NEMS)"

In this paper the process of development a OntoMEMS ontology of Microelectromechanical Systems (MEMS) and Nano-electromechanical Systems (NEMS) are present. [C57]

### "Sum-frequency generation as an ultrafast quantum detector for Heisenberg scaled phase measurement"

We describe ultrafast detection of quantum correlations using broadband sum-frequency generation as a physical two-mode detector. We apply the detection scheme to measurement of broadband squeezing and to phase estimation at the Heisenber limit. [C58]

### "Force-mediated parametric generation in nano-optomechanical structures"

We report a novel scheme for freely engineering phase matching, enabling efficient parametric generation at arbitrary frequencies in mechanically compliant nano-optomechanical structures. [C59]

### "Effective suppression of in localization and piezoelectric field in InGaN multi quantum-wells by growth on nano scale pyramidal facets"

We have grown multi quantum wells (MQWs) with a peak wavelength of 570 nm on nano scale GaN hexagonal pyramid structures with facets formed by (11-22) planes by selective metal organic vapor phase epitaxy (MOVPE). The height, the bottom diameter and the pitch of the pyramid are 350 nm, 300 nm, and 500 nm, respectively. Photoluminescence (PL) measurements from 10 to 300 K show monotonic decrease in emission peak energy of the MQW with temperature increase without showing the typical S-shaped curve caused by In localization. Power dependent PL shows no noticeable blue shift cased by piezoelectric field screening effect. With a comparative study with MQWs on micro size pyramids, we find that elastic strain relaxation by nano size of the structure is responsible to the uniform In distribution and reduced piezoelectric field in addition to the semipolar growth plane. [C60]

### "Integration of nano-photonic devices for CMOS chip-to-chip optical I/O"

This paper describes an optical interconnect solution based on a monolithic photonic CMOS architecture. A photonic CMOS process enables higher bandwidth and lower energy-per-bit for chip-to-chip optical I/O through integration of electro-optical polymer based modulators, silicon nitride waveguides and polycrystalline germanium (Ge) photodetectors in a CMOS logic process. Experimental results for both the photonic CMOS ring resonator modulators and Ge detectors demonstrate 40 Gb/s performance. [C61]

### "Optimization of Micro and Nano Research and Development Fabrication Operations"

Summary form only given. In order to stay competitive in today's markets, companies are faced with lowering the cost of research and development while increasing technology capacity, reducing research lot cycle times and maintaining process control, and improving quality of numerous technology platforms. This poster will present an overview of the strategy and outcome of a multi year effort to improve the productivity of General Electric's Global Research Center (GRC) micro and nano systems technology (MNST) semiconductor cleanroom operations. A lean six-sigma approach was used to identify and analyze metrics that would lead to an understanding of factors critical to fab efficiency. Initiatives showed areas of improvement to be centered around: cleanroom equipment, fab lot loading/priority, documentation, and equipment. Further analysis revealed key metrics to analyze and track performance as, throughput, equipment uptime, process time, and process lot queue time. After implementing this lean six sigma approach metric data showed an initial cycle time improvement of more than 3X, a 41% queue time reduction from 2006 to 2009 and a 30% productivity improvement while realizing an overall fab loading increase of 54% from 2006 to 2009. [C62]

### "Performance Improvement of Polymer Based Solar Cell by Ordered Nano-Morphology"

Polymer based organic solar cell offers a relatively inexpensive option for the future solar cell technology, provided its efficiency increases beyond the current limit of 4-6%. In this paper, we use the process and device models to explore the possibility of the efficiency improvement of the solar cell by ordered active layer morphology, obtained through template based fabrication technique. Our analysis shows that ordered morphology improves both photon collection as well as carrier transport and hence promises to double the cell efficiency. [C63]



### "Sustainable scale-up studies of Atomic Layer Deposition for microelectronics manufacturing"

Atomic Layer Deposition (ALD) is a promising nanotechnology under rapid development for a wide variety of industrial applications. Wide application of ALD technology in industrial productions can generate significant impact on the environment and human health due to the toxic chemicals involved and process emissions generated from ALD production system. In this paper, we conducted computational analysis on a 10 wafer ALD processing system to study the sustainability performance of ALD technology during its batch size production. The simulation is performed on the ALD of Al<sub>2</sub>O<sub>3</sub> high-k dielectric gate in microelectronics manufacturing based on the Cambridge Nanotech's Savannah S100 system which is capable of processing 10 wafers simultaneously through a 10-wafer cassette sitting in the reactor covered by a dome lid. The sustainability analyses are performed by quantitatively investigating the production productivity, precursor emissions, greenhouse gas emissions, and nano-wastes generated from the ALD Al<sub>2</sub>O<sub>3</sub> processes. The study shows that huge amounts of environmental emissions will be generated, and current ALD nanotechnologies must be significantly improved before its wide implementation in various industrial sectors. [C64]

### "Fabrication Facilities and Operational Model at MIT's Microsystems Technology Labs"

The mission of the Microsystems Technology Laboratories (MTL) is to provide facilities for education and research in micro and nano technology and innovative devices. This paper describes details of its operation, including cost structure, fab management and billing software, interactions with industry, government labs and other universities will be described. [C65]

### "Multi-walled carbon nanotube impedance"

In future technologies, people will confront with traditional Cu interconnect problems and there is a widespread demand for single-walled carbon nanotube (SWCNT) and multi-walled carbon nanotube (MWCNT). One of the most important parts in carbon nanotube interconnects is their impedance. Thus we investigate impedance, especially dc resistance, in multi walled carbon nano tube interconnect in low and high bias voltages for different geometries. The total dc resistance of an MWCNT is then calculated and an equation was obtained. We have also investigated the behavior of MWCNTs, in both low and high damping modes, in high bias regime. The results for delay and power showed better performance for MWCNT's interconnect compared to those for Cu's. [C66]

### "CVD Co and its application to Cu damascene interconnections"

Fundamental material interactions as pertinent to nano-scale copper interconnects were studied for CVD Co with a variety of micro-analytical techniques. Native Co oxide grew rapidly within a few hours (XPS). Incorporation of oxygen and carbon in the CVD Co films (by AES and SIMS) depended on underlying materials, such as Ta, TaN, or Ru. Copper film texture (by XRD) and agglomeration resistance (by AFM) showed correlations with amounts of in-film oxygen/carbon. Cobalt diffused through copper at normal processing temperatures (by SIMS). CVD Co demonstrated diffusion barrier performance to Cu (by Triangular Voltage Sweep, TVS), but not to O<sub>2</sub>. CVD Co was applied to 32 nm/22 nm damascene Cu interconnect fabrication in a scheme defined by the material studies. Lower post-CMP defect density and longer electromigration lifetimes were obtained. [C67]

### "Bridging the HPC Processor-Memory Gap with Quilt Packaging"

High performance computing (HPC) systems are constrained in the areas of performance, power, and cooling. A new 2D technology, called "Quilt Packaging," is presented as a possible solution to positively impact the processor-memory connection in these areas. A straw man architecture based on current HPC nodes in the RedStorm system at Sandia National Laboratories is used to explore the effects of Quilt Packaging on the connection between processor and memory. [C68]

### "The VINSE Core Laboratories: Opportunities, Challenges and Lessons Learned at Year 6"

In 2004 Vanderbilt University announced the design and construction of a 1635 sq. ft. class 10000-cleanroom facility to support the research mission of the Vanderbilt Institute of Nanoscale Science and Engineering (VINSE). By design we have brought together disparate technologies and researchers formerly dispersed across the campus, and across middle Tennessee, to work together in a contiguous space intended to foster interaction and synergy of nano-technologies not often found in close proximity. The space hosts a variety of tools for lithographic patterning of substrates, the deposition of thin films, the synthesis of carbon-based nanostructures, and a variety of reactive ion etchers for the fabrication of nanostructures on planar substrates. In addition, a separate 911 sq. ft. chemistry laboratory supports nanocrystal synthesis and the investigation of biomolecular films. The design criteria required an integrated space that would support the scientific agenda of the laboratory



while satisfying all applicable code and safety concerns. VINSE has enjoyed much success over the years as evidenced by the quality of faculty recruitment, the publication of peer-reviewed science, new research funding, and the number and quality of students who have completed their research in our laboratories and graduated with advanced degrees. As the facility matures we face lingering issues of cost recovery and maintenance of the physical plant at a private University. [C69]

### "Carbon Nanotubes Flat Panel Displayer Fabricated and Its High Voltage Drive Circuits Designed"

Carbon nanotubes field emission displays are new type modern flat panel displays, its research work is based on development of NANO technology and carbon nanotubes. In order to simplify the fabricated processes for flat panel displays, the printed carbon nanotubes cathode is used to instead of the micro-tip which was made by silicon photolithography. The control and drive circuits, especially the cathode high voltage drive circuits are one of more important research contents for carbon nanotubes cathode field emission displays, the optimum designed drive circuits will directly affect the quality of display and also cost of the displayer for sales, and few reports of control and drive systems are found in this area. In this article, the structure and characters of several high voltage drive circuits are analyzed and compared based on the research for carbon nanotube field emission displays, then proposed the optimized CMOS structure high voltage drive circuits, which constructed by high and low breakdown voltage MOSFETs, so reduced the circuits power dissipation and enhanced the response speed, more important, this circuits structure is easy to integration. The logic function of designed circuits is verified by spice simulation, and its output speed response are measured by made the test circuit boards. The designed circuits are used to drive our fabricated black-white 5-inch carbon nanotubes field emission displayer and result the stability and dynamic vision effects and high resolution display performances. [C70]

### "Metamaterials in antenna design and technology"

In this contribution, we present some designs showing the possible benefits of the employment of metamaterials in antennas. We show how cloaking devices, commonly used to reduce object observability, may be used to limit the negative effects due to the presence of obstacles in the near-field of an antenna. When going at optical frequencies, we show that metamaterials may be used to design proper screens to enhance the otherwise poor directivity of nano-antennas. [C71]

### "An Study on Laser Propagation Characteristics of Skin in Vivo"

Laser has been used clinically as a therapeutic tool for at least twenty years and has achieved good clinical results. An understanding of optical properties of tissue is important for these applications. However, applying the rigorous electromagnetic theory to analyze light propagation in tissue is almost impossible. Therefore, several approximate analysis approaches to model the light propagation in tissue were introduced. In this study we tried to measure the power of diffuse light on body surface non-invasively and brought the data into comparison. Five positions which the superficial tissues are different were selected and Automation Control Technology was used to improve measurement efficiency and accuracy. Our study suggests that the distributions of diffuse light along different paths on the surface of skin are conformed to exponential attenuation law but the attenuation coefficients are different. Otherwise, the exponential attenuation coefficient of the same position is also influenced by the gender of subject. [C72]

### "Influence of Temperature and Vacuum on Nano-Diamond Filed Emission"

In order to obtain the stabilized operating temperature and vacuum of nano-diamond filed emission display, the influence of temperature and vacuum changes on nano-diamond filed emission was studied, and the mechanism of field emission under high temperature and low vacuum was analyzed. It was found that nano-diamond filed emission turn-on filed decreases, and current density increases as the temperature increases. After the temperature increases to 130°C, filed emission starts to deviate from the traditional Fowler-Nordheim theory. Under low vacuum, nano-diamond field emission is very unstable. As the vacuum increases, turn-on filed decreases, and current density increases. However, when the vacuum increases to 10-4Pa level, turn-on filed, current density, and luminescence effect becomes stable. vacuum can decrease with the increase of temperature. When the temperature is below 150°C, the decrease of the vacuum will not influence the stability of field emission. When the system operates stably, the temperature of cathode surface should be below 130°C, and the vacuum should be above 10-4Pa level. [C73]

### "Propagation models for nanocommunication networks"

Nanotechnology is enabling the development of devices in a scale ranging from one to a few hundred nanometers. Communication among these nano-devices will expand the capabilities and applications of individual devices both in terms of complexity and range of operation, enabling new applications of



nanotechnology in the medical, environmental and military fields as well as in consumer and industrial goods. Despite major progress in the design and manufacturing of these devices has been accomplished to date, it is still not clear how they are going to communicate. Two main alternatives for communication among nano-devices have been envisioned, namely, molecular communication, i.e., the transmission of information encoded in molecules, and nano-electromagnetic communication, which is defined as the transmission and reception of electromagnetic radiation from nanoscale components based on novel nanomaterials. In this paper, propagation models for both communication paradigms are discussed, emphasizing the challenges in nanocommunication networks. [C74]

#### **"A nano-optical Yagi-Uda antenna driven by single emitters"**

Optical antennas are the counterparts of conventional radio frequency and microwave antennas for frequencies in the visible regime (~500 THz) [1]. They localize optical fields to sub-diffraction-limited volumes, enhance and redirect the excitation and emission of quantum emitters [2] as well as modify their spectra. They open up exciting opportunities in a wide range of fields including nonlinear light-matter interaction and superresolution microscopy. [C75]

#### **"Graphene-based nano-antennas for electromagnetic nanocommunications in the terahertz band"**

Nanotechnology is enabling the development of devices in a scale ranging from one to a few hundred nanometers. Coordination and information sharing among these nano-devices will lead towards the development of future nanonetworks, boosting the range of applications of nanotechnology in the biomedical, environmental and military fields. Despite the major progress in nano-device design and fabrication, it is still not clear how these atomically precise machines will communicate. Recently, the advancements in graphene-based electronics have opened the door to electromagnetic communications in the nano-scale. In this paper, a new quantum mechanical framework is used to analyze the properties of Carbon Nanotubes (CNTs) as nano-dipole antennas. For this, first the transmission line properties of CNTs are obtained using the tight-binding model as functions of the CNT length, diameter, and edge geometry. Then, relevant antenna parameters such as the fundamental resonant frequency and the input impedance are calculated and compared to those of a nano-patch antenna based on a Graphene Nanoribbon (GNR) with similar dimensions. The results show that for a maximum antenna size in the order of several hundred nanometers (the expected maximum size for a nano-device), both a nano-dipole and a nano-patch antenna will be able to radiate electromagnetic waves in the terahertz band (0.1-10.0 THz). [C76]

#### **"Nano-optical trapping by resonant optical antennas of Rayleigh particles and E-coli bacteria"**

Trapping living microorganisms at designated positions in space is important to study their metabolism and to initiate an in-situ scrutiny of the complexity of life at the nanoscale. While optical tweezers enable to trap large cells at the focus of a laser beam, they face difficulties in maintaining them steady and can become invasive and produce substantial damage that prevents preserving the organisms intact for sufficient time to be studied. Here we demonstrate a novel optical trapping scheme that allows us to hold living E-coli bacteria for times of several hours using moderate light intensities. We pattern metallic nanoantennas on a glass substrate to produce strong light intensity gradients responsible for the trapping mechanism. Several individual bacteria are trapped simultaneously, with their orientation fixed by the asymmetry of the antennas. This unprecedented immobilization of bacteria opens an avenue towards observing nanoscopic processes associated to cell metabolism, as well as the response of individual live microorganisms to external stimuli, much in the same way as pluricellular organisms are studied in biology. [C77]

#### **"A study of the relationship between on-chip power distribution network voltage noise, charge per clock cycle, on-chip decoupling capacitance and clock jitter in a 40-nm field programmable gate array test chip"**

As technology process nodes continue to shrink, the performance of nano-technology devices becomes increasingly dependent on power quality. With core logic voltage reduced to 0.9 V, 40-nm devices are more susceptible to on-chip power distribution network (PDN) voltage noise. On-chip PDN voltage noise increases jitter and reduces a circuit's timing margin, which may lead to performance failures due to timing violations. This paper presents a study of the relationship between on-chip PDN voltage noise, charge per clock cycle (QCYCLE), on-chip decoupling capacitance (ODC), and internal clock period jitter. This study investigates the impact of on-chip PDN voltage noise, generated by switching internal logic elements, on jitter performance using two Altera 40-nm field programmable gate array (FPGA) test chips. The results from this study can aid chip designers in optimizing power quality, thereby achieving error-free timing design goals. [C78]



### "Memristor system properties and its design applications to circuits such as nonvolatile memristor memories"

Novel nonvolatile universal memory technology is essential for providing required storage for nano-computing. As a potential contender for the next-generation memory, the recently found "the missing fourth circuit element", memristor, has drawn a great deal of research interests. In this paper, by starting from basic memristor device equations that assumes constant ion mobility, we develop a comprehensive set of properties and design equations for memristor based memories. Our analyses are specifically targeting key electrical memristor device characteristics relevant to, but not limited to, memory operations. However, like many nano devices, a small voltage drop across the memristor will yield an enormous electric field, which may produce significant highly nonlinear ionic transport that the linear drift assumption no longer holds for realistic memristors. Issues such as how to design circuits facing such nonlinear drift will be discussed. In addition, issues such as how to sense the memory states and perturbations during sensing will be addressed. In this paper, we demonstrate that we can successfully use the derived properties based on the linear drift model to design read and write circuits and analyze important data integrity and noise-tolerance issues for realistic nonlinear drift models. [C79]

### "Challenges and Perspectives of Computer Architecture at the Nano Scale"

Advances in nanotechnology and the research of new materials has led to the elaboration of nano-components with novel properties and functions. Exploring how those novel components could be used to devise future computer architectures, complementing rather than supplementing CMOS technology, is a new research subject known as Nanocomputing. In this talk we will present the major challenges of such a research, the potential benefits of using technologies other than CMOS and some perspectives in terms of design and applications. We will illustrate the topic by presenting some of the most advanced results in the field, focusing on results from the European project FP7, NABAB, that explores how to build neuro-inspired computing structures with a variety of nanotechnologies. [C80]

### "Reliability Analysis and Improvement in Nano Scale Design"

According to the shrinking feature size of the VLSI circuits it is expected that nano scale devices and interconnections will introduce unprecedented level of defects and architectural designs need to settle with the uncertainty result at such scales. Several approaches for implementing the fault tolerance systems are already investigated. Most of these methods are applicable also in the case of high fault rates. Most protection methods are based on different redundancy methods which add extra detection and correction features to the design. We strongly believe that in future architectures it become more important assessing the fault tolerance techniques. Having an estimation of system fault tolerance can ensure critical applications working properly. In this work we propose a new method which checks reconfigurable architectures and during runtime finds violent spots in the design for probable transient and permanent failures. This approach is adjustable to either current FPGAs or future nano-architectures which are based on reconfigurability. We define a fault detection model for probable errors which uses an efficient algorithm that proves the fault tolerance in the reconfigurable architecture and computes a reliability factor for the architecture. This helps avoiding using the critical parts by future usages. Our method is applicable to different levels of granularity, such as gate level, logic block level, logic function level, unit level, etc. It is efficient and fast and can be simply integrated into the design flow. [C81]

### "Effect of nano-TiO<sub>2</sub> addition on wettability and interfacial reactions of Sn<sub>0.7</sub>Cu composite solder/Cu solder joints"

The influences of intermixing nano-TiO<sub>2</sub> particles on the wettability and interfacial reaction of Sn<sub>0.7</sub>Cu composite solder with Cu substrate were investigated. The wettability of the Sn<sub>0.7</sub>Cu composite solder alloy was measured by the sessile-drop method under a 10<sup>-3</sup>Torr vacuum solder at 250 °C up to 1800 s. Scanning electron microscopy (SEM) was used to quantify the interfacial microstructure for each processing condition. The wettability property was improved by 0.25-1.0 wt.% addition of nano-TiO<sub>2</sub> particles into the Sn<sub>0.7</sub>Cu solder. Intermetallics formed at the Sn<sub>0.7</sub>Cu composite solder/Cu interface were identified as Cu<sub>6</sub>Sn<sub>5</sub> adjacent to the solder and Cu<sub>3</sub>Sn IMCs adjacent to the Cu substrate, respectively. The addition of nano-TiO<sub>2</sub> particles to the Sn<sub>0.7</sub>Cu solder effectively repressed the growth of the IMC layer at the interface. [C82]

### "Reliability characterisation of Bi-modal high temperature stable Isotropic Conductive Adhesives"

Conductive adhesives are generally considered to be one of the strongest candidates for replacement of solder in electronics industry. However, some problems related to the performance have so far limited wider applications of conductive adhesives. One of the major problems is tendency to degrade during temperature and humidity aging. In this paper, two kinds of Isotropic Conductive Adhesives (ICA) with high temperature stable



matrix and different fillers were fabricated. The first one was fabricated by simply adding silver flakes into matrix as filler using this high temperature stable matrix based on highly cross-linked aromatic functional groups. For the second one, in addition to silver flakes, nano-silver particles with different weight percentages were also added as filler into matrix to form a bi-modal ICA. The weight percentages of nano-silver particles in filler are 1wt%, 2wt% and 3wt% respectively. The filler content of these two ICAs are both 75wt% in total. All test samples were cured at 150°C for 1 hour. The random distribution of the silver flakes in the adhesive was observed by SEM. The bulk resistivity of the ICAs with different fillers was investigated to characterize the electrical conductivity of the ICA. The results show that addition of small amount of nano-silver particles improve the electric conductivity of the ICA but the excessive amount of nano-silver particles led to the increase of the ICA's bulk resistivity. The humidity (85°C/85RH) test was carried out and the resistances of the samples were measured. It was shown that some electrical resistance increase was observed during the humidity testing with time. The addition of the nano-particles has also some negative effect of the electrical resistance change. But the effect is limited in a few percentage range of the nano-particle addition. [C83]

#### **"Design of Low Loss Beam Forming Networks-supported by numerical simulations and material characterisation"**

Beam forming networks (BFN) distribute transmission signals to an antenna system at satellites in the orbit which enable energy-efficient multi-media communication. A new approach to BFN is presented which combines structural and electrical functions in a single multilayer board in contrast to traditionally milled metal bodies. [C84]

#### **"Preparation of nano silver pastes applied in printed electronics"**

Printed electronics have become research focus due to their distinct characteristics such as tiny, flexible, thin, and easy to carry. Printed electronics have shown great potential in daily use, such as RFID tags, smart cards and displays. Silver nanoparticles have been applied as conductors in printed electronics. Different kinds of chemicals are used as solvent and stabilizers to prepare nano silver pastes in the paper. Silver nanoparticles are well distributed in the chemicals by ultrasonic method. The nano silver pastes are deposited on glass slides. Nano silver pastes are annealed at certain temperature to thermally decompose the stabilizers and solvent. The resultant nano silver films are sintered and highly conductive. The resistivity of conductive silver films prepared by using lactic acid and ethylene glycol was  $2.6 \times 10^{-5} \Omega \cdot \text{cm}$  after annealing at 200°C for 30 min, and the resistivity was  $6.4 \times 10^{-6} \Omega \cdot \text{cm}$  when the silver conductive films was annealed at 250°C. The microstructures of conductive lines formed by this method are investigated by SEM and SPM. [C85]

#### **"Computer simulation for electroluminescence efficiency and multi-peak structure of nano-porous oxidized silicon photodiode"**

Based on the semiconductor heterojunction theory and three-layer model of Si-SiO<sub>2</sub>, the expressions of electroluminescence intensity ratio of interface layer to silicon core were deduced. The result can explain the low electroluminescence efficiency and the phenomenon of multi electroluminescence peak of nano-porous oxidized silicon well. Simulation results show that: 1)  $\Delta E$  has a great influence on the recombination efficiency. The recombination efficiency of carriers in the heterojunction boundary is higher than other regions. 2) Core and the interlayer can electroluminescence both, the apparent of luminescence peak position of nano-porous oxidized silicon photodiode and the phenomenon of multi-emission peak depend on the band gap difference of core and interlayer. The proposed methodologies in this paper have benefits on realizing full silicon-based optoelectronic integrated circuits. [C86]

#### **"Fuel gas production from catalytic steam gasification of municipal solid wastes"**

The catalytic steam gasification of municipal solid wastes (MSW) for fuel gas production was experimentally investigated in a combined fixed bed reactor using the newly developed nano-NiO/ $\gamma$ -Al<sub>2</sub>O<sub>3</sub> catalyst. A series of experiments have been performed to explore the effects of catalyst presence, catalytic temperature, steam to MSW ratio (S/M) and MSW particle size on the composition and yield of gasification gases. The experiments results indicated that the supported NiO/ $\gamma$ -Al<sub>2</sub>O<sub>3</sub> catalyst had a high activity of cracking tar and hydrocarbons as well as upgrading the gas quality in catalytic steam gasification of municipal solid wastes. Catalytic temperature was crucial for the overall gasification process, a higher temperature contributed to more hydrogen production and gas yield. Comparing with MSW catalytic gasification, the introduction of steam improved gas quality and yield, the S/M ratio of 1.33 was found as the optimum operating condition in the catalytic steam gasification of municipal solid wastes. It was also shown that a smaller particle was more favorable for gas quality and yield. [C87]

#### **"Improvement of junction characteristics of ultra shallow junction with boron-cluster implantation"**



### and Ni-silicide for nano-scale CMOS technology"

In this paper, novel Ni silicide on boron cluster implanted source/drain junction is proposed and its thermal stability characteristics are analyzed in depth. The proposed Ni-silicide (Ni-Pd(5%)/TiN) is compared with pure Ni/TiN structure and the effect of boron cluster on the shallow junction of high performance MOSFETs is characterized. [C88]

### "P1-18: I-V Characteristics of nanogap electrodes formed by thermally assisted electromigration"

Electrodes with nano-scale gaps have been fabricated using metallic nano-wires, derived via milling of thin films with focused ion beam (FIB) and passing current  $\sim 1012 \text{ A/m}^2$ . Their I-V characteristics measured at a pressure  $\sim 10^{-6} \text{ mbar}$  are shown to follow Child-Langmuir law or Fowler-Nordheim field emission depending upon the gap. [C89]

### "Photocatalytic degradation of methylene blue by magnetically separable BiVO<sub>4</sub> supported on Fe<sub>3</sub>O<sub>4</sub> nanoparticles"

Non-titania photocatalyst BiVO<sub>4</sub> was supported on SiO<sub>2</sub>-coated Fe<sub>3</sub>O<sub>4</sub> particles in order to solve the problems of photocatalyst recovery and reuse. The prepared photocatalyst BiVO<sub>4</sub>/SiO<sub>2</sub>/Fe<sub>3</sub>O<sub>4</sub> (BiVO<sub>4</sub>/SFN) was proved to be nano-sized (less than 10 nm) by TEM characterization. The superparamagnetism of BiVO<sub>4</sub>/SFN was confirmed by a vibrating sample magnetometer (VSM). The photocatalyst can be easily separated experimentally by an external magnetic field in lab. XRD analysis proved the dominant existence of BiVO<sub>4</sub> crystals. The magnetic photocatalyst BiVO<sub>4</sub>/SFN showed high photoactivity for methylene blue (MB) decolorization under visible light above 400 nm (72.1%) and a lower activity (21.8%) was observed under line spectra at 420 nm. MB was almost not degraded by P25 titania at 420 nm. The reusability experiment under visible light irradiation also demonstrated the potential application of magnetic photocatalyst in water and wastewater treatment. [C90]

### "Sensing inside explosions: Thermal history deduced from microparticle luminescence"

Fires and explosions are some of the most difficult environments in which to perform sensing. A technology is reviewed that measures the temperature versus time relationship of such rapid thermal events. It utilizes the dependence of luminescence on the trap populations of dispersed micro- and nano-particles. The thermoluminescence (TL) of various oxide microparticles gives direct information on temperature and time because the trapped charges that ultimately give rise to TL have a probability of detrapping that follows an Arrhenius-type relationship. To test this concept, Mg<sub>2</sub>SiO<sub>4</sub>:Tb,Co particles with two thermoluminescent peaks have been heated using micromachined heaters over a 232°C to 313°C range on time scales of less than 200ms. The effect of maximum temperature during excitation on the intensity ratio of the two luminescent peaks has been compared with first-order kinetics theory and shown to match within an average error of 4.4%. Other TL particles have recently been tested and shown to survive Pentaerythritol Tetranitrate (PETN) explosions. [C91]

### "Preparation and photocatalytic activity of magnetic Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> photocatalyst"

Porous nano-TiO<sub>2</sub> prepared by the sol-gel technology was coupled with Fe<sub>3</sub>O<sub>4</sub> which is magnetic material prepared by marinating-calcining method to afford the magnetic porous coupling Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> photocatalyst, the title compound was characterized. In this paper, we investigated the degradation to the bromamine acid solution under the fluorescent light and the effects of different adulterant proportion of Fe<sub>3</sub>O<sub>4</sub> and calcining temperature to the degradation performance. The effects of the different dosages of photocatalyst were also discussed. The results show that when Fe<sub>3</sub>O<sub>4</sub> adulterant proportion (molar ratio) is 5%, calcining temperature is 500°C and the dosage is 4g/L, the removal rates of chroma and total organic carbon to bromamine acid solution reached 98.35% and 80.69% respectively. [C92]

### "Analysis on nano biomedical components of wood from Cinnamomum camphora by Py-GC/MS"

Cinnamomum camphora belonging to Lauraceae, Cinnamomum, Sect is a kind of economic forest woods with an important using value. It is not only one of excellent green and timber tree species, but also one of significant species of fragrant plant. Volatile oils are contained in the organs of the plant, such as roots, tree-trunks, leaves, branches and fruits. The chemical components of volatile oils are materials for chemical industry. This article takes volatile oil from Cinnamomum camphora as the target, discusses and compares extractions, analysis methods and the components from volatile oil of Cinnamomum camphora. Study the extractive technology of the volatile oil of Cinnamomum camphora and identify its chemical compositions; Study inclusion technology for inclusion compound of the volatile oil of Camphora. [C93]



### "Automated Test Case Generation of Self-Managing Policies for NASA Prototype Missions Developed with ASSL"

Self-managing policies provide a self-management behavior for autonomic systems developed with ASSL (Autonomic System Specification Language). With ASSL we have successfully developed special autonomic prototypes of both the NASA ANTS (Autonomous Nano-Technology Swarm) concept mission and NASAs Voyager Mission. In these prototypes, we applied ASSL self-managing policies to drive the missions in critical situations in response to environmental or system changes. Therefore, the logical correctness of the ASSL specification of such policies appears to be of major importance. Experience has shown, however, that ASSL specifications may contain logical faults causing improper behavior. To handle such behavior, self-managing policies are often tested with manually injected inputs triggering events and satisfying constraints to allow for the activation, execution, and deactivation of these policies. The logical correctness of an ASSL self managing policy currently depends solely upon the relation between inputs and conclusion. In this paper, we present our initial work on a novel tool, part of the ASSL framework, that generates test cases based on change-impact analysis. Our main goal is to reduce testing costs and effort and improve the quality of testing, thus eventually assuring the logical correctness of the self-managing policies developed with ASSL. [C94]

### "Progress in silicon photonics and recent activities in Asia"

In recent years, silicon photonics has become a major topic in optoelectronics, involving micron-scale high-index-contrast structures, forming flexible on-chip networks. Further functionalities are integrated through fine nano-structures, pin junctions, epitaxially grown materials, hybrid technologies, etc., while its compatibility with CMOS processes promises large-scale integration and low-cost mass-production. This workshop reviews recent progress in passive, active and functional photonic devices on silicon platform, their applications to fiber communications and on-chip optical interconnects, and recent low-cost foundry services. It also highlights rapidly-growing silicon photonics R&D in Asia, particularly in Hong-Kong, Korea, and China. [C95]

### "Automated nanorobotic handling of bio- and nano-materials"

Automated handling on the nanoscale is a crucial challenge for commercialization of bio- and nano-technologies. This paper describes current implementations towards two fields of application: Micro-nano integration for NEMS prototyping, and biosensor development. (1) The integration of nanomaterials into micro-systems can improve the properties of such systems and enable novel innovative solutions. Using nanorobotic systems operating inside the vacuum chamber of a scanning electron microscope is a promising approach. Nanorobotic strategies for the microgripper-based handling with focus on automation are presented. A fully automated handling sequence demonstrates the micro-nano integration of prototypic nanotube-enhanced atomic force microscope probes. (2) Nanorobotic systems employing an atomic force microscope are a promising approach for the handling of nanoscopic biomaterials. Methods for the handling of DNA to design bio-nano chips and to solve packaging problems on the nanoscale are presented. Additionally, an AFM-based approach for the structuring of biomaterials is presented. [C96]

### "Content list"

The following topics are dealt with: disruptive technology; semiconductor manufacturing; production scheduling; inventory management; production systems; information and communication technologies; sustainable manufacturing; life sciences; laboratory automation; industrial robots; green manufacturing; microrobots; nanorobots; automata; Petri nets; distributed systems; vision processing; image processing; adaptive manufacturing; computational intelligence; mobile vehicles; micro-nano manipulation; active thermal management; pharmaceutical lead discovery; health care automation; mechatronics; planning; material processing automation; medical automation; supply chain logistics. [C97]

### "Performance of F-CNTs sensors towards ethanol vapor using different functional groups"

Ethanol vapor sensors utilizing functionalized carbon nanotubes as sensing elements have been successfully built. The Au microelectrodes on the silicon substrate were fabricated by MEMS technology and the carbon nanotubes connection was achieved by DEP manipulation. Chemical oxidation method was used to graft functional groups such as COOH and OH on multi-walled nanotubes (MWNTs). Sensor performance using COOH-MWNTs and OH-MWNTs were compared in terms of various aspects, such as I-V curve, responsivity, sensor performance under different input current and time constant. Both sensors showed negative Temperature Coefficient of Resistance (TCR) and sharp resistance increase upon exposure to the ethanol vapor. Moreover, we observed the trends of decreased response and prolonged response time while the activation current was raised gradually. In addition, COOH-MWNTs based sensors have proved to be more sensitive towards ethanol



vapor compared to OH-MWNTs. [C98]

### "Nano-patterned AlGaInP light-emitting diode based on UV-Kiss metal transfer technology"

This paper describes a new nano-patterning technique, the UV-Kiss Metal Transfer (UV-KMT) method, and applies it for patterning micro/nano-structures on AlGaInP light-emitting diodes (LEDs) for enhancing their light extraction efficiency. First of all, an ETFE mold with micro/nano-features is replicated from a silicon master mold. A thin metal film is then deposited on the ETFE mold which has very low surface energy. A layer of UV curable polymer solution is spin-coated on an AlGaInP LED surface. The metal-film coated ETFE mold and the UV-polymer coated LED are brought into contact with a uniformly distributed pressure of 0.1 MPa, and UV light is radiated through the ETFE mold and solidifies the UV polymer. The solidified UV polymer has stronger adhesion to the metal film in contact with, and therefore can transfer the metal pattern defined by the convex surface feature of the ETFE mold onto the AlGaInP LED surface. The transferred metal pattern is then serving as an etching mask for RIE etching on the underlying UV polymer layer. Finally, a patterned structure consisting of a metal film on top and an underlying UV polymer layer is formed on the LED surface. This metal/polymer surface structure can well serve as an etching mask again for ICP etching on the LED, and hence complete the fabrication of micro/nano-structures on the top surfaces of AlGaInP LEDs for enhancing their light extraction efficiency. The optical power measurement using an integrating sphere shows that the extraction efficiency of the patterned LED is 25% higher than that of the conventional LED. In short, we demonstrate an easily implemented, cost effective, and powerful method to pattern LED substrate. [C99]

### "Basic study of coupling on Si waveguides of grade separation by numerical analysis"

Si optical nano-wire waveguide is an important elemental technology that achieves optical wiring in the Si Photonics. We think that the adoption of the grade separation waveguide is inevitable for achievement of more advanced integration and the miniaturization of chips and devices such as the matrix switches. Mutual coupling on the grade separation waveguides can be evaluated quantitatively by numerical analysis tool. When the waveguide to be able to propagate two dominant modes is used, it is shown that two modes induced on overpass by an input mode on underpass. [C100]

### "Infrared-assisted and roller-based direct metal contact transfer technology for flexible polarizer"

In this paper we report the fabrication of metallic nano-wired polarizer on polymer substrate based on infrared assisted and roller based direct metal contact transfer technology. This method effectively resolves several serious problems in conventional hot-embossing types of nano-imprinting such as uniformly applied pressure and thermal deformation of the flexible substrate due to over heating. In this new contact printing process, we utilize a glass cylinder to keep the PET substrate being in contact with the mold constantly and stably. To avoid over heating and thermal deformation, an infrared light is used to heat up the surface of the PET substrate and achieves localized melting of the polymer surface. After PET heating, the metallic grating patterns which are per-deposited on the Si mold are transferred on the PET substrate, hence forms a flexible polarizer of metallic grating. In addition, this method does not need chemical etching in or after the transfer process so that it significantly simplifies the printing procedures. We have successfully produced a number of metallic nano-wired flexible polarizers easily by this infrared-assisted and roller-based direct metal contact transfer technology, and their optical performance has been experimentally characterized. [C101]

### "Electrochemical behavior of a new Sn3.5Ag0.5Cu composite solder"

For application of a lead-free composite solder in advanced electrical components, lead-free Sn3.5Ag0.5Cu composite solder was produced by mechanically mixing 0.5 wt.% nano-TiO<sub>2</sub> particles with Sn3.5Ag0.5Cu solder. The corrosion behavior of the new Sn3.5Ag0.5Cu composite solder in 3.5 wt.% NaCl solution was investigated by using potentiodynamic polarization methods. The corrosion products formed during the polarization study were analyzed with scanning electron microscopy (SEM) and X-ray diffraction. Potentiodynamic polarization curves show that the new Sn3.5Ag0.5Cu composite solder exhibits better corrosion resistance than Sn3.5Ag0.5Cu solder. The corrosion product on the surface of all these solders was tin oxide chloride hydroxide. [C102]

### "Dielectric properties of Ag@SiO<sub>2</sub>/epoxy composite for embedded capacitor applications"

Nano-sized Ag particles were prepared through a wet chemical reduction route and treated with tetraethoxysilane (TEOS) to form an amorphous SiO<sub>2</sub> thin layer on the particles surface (Ag@SiO<sub>2</sub>). Ag@SiO<sub>2</sub>/Epoxy composite film was fabricated via coating process. The experimental results showed that the dielectric constant  $k$  increased gradually with Ag@SiO<sub>2</sub> content before reaching the percolation threshold. The value of dielectric constant  $k$  was 28 at 100 Hz for the composite containing 20 vol% Ag@SiO<sub>2</sub>, which was 5



times larger than that of the pure epoxy resin. In contrast, the value of loss  $\tan\delta$  remained at a low level ( $<0.02$ ) before reaching the threshold.  $\tan\delta$  was 0.014 for the composite containing 20 vol% Ag@SiO<sub>2</sub>, which was even lower than that of the pure epoxy resin (0.018). When the Ag@SiO<sub>2</sub> content reached 25 vol%, both of the  $k$  and  $\tan\delta$  values increased substantially, indicating formation of conducting pathway between Ag particles. The results implied that when Ag@SiO<sub>2</sub> content was at a low level, the insulating SiO<sub>2</sub> shell served as electrons barrier layer between Ag cores and prevented electrons from transferring from one Ag core to another under an external field. As a result, the measured  $k$  value increased with Ag@SiO<sub>2</sub> content, while the  $\tan\delta$  remained low. However, when Ag@SiO<sub>2</sub> filler loading reached a higher level and was in the vicinity of critical concentration, Ag cores were so close to each other and the conducting pathway could be developed in the amorphous SiO<sub>2</sub> shell, leading to remarkable growth of  $k$  and  $\tan\delta$ . [C103]

### "Improving the humidity resistance of electronic packaging materials by micro-nano hierarchical structured silica"

Micro-nano structured silica particles were synthesized successfully by grafted 4,4'-diphenylmethane diisocyanate (MDI). We report a robust procedure for preparing superhydrophobic materials with the advancing water contact angle (WCA) of about 155°. Micro-nano structured surface roughness, which mimics the surface topology of self-cleaning plant leaves, originates from well-defined micro-nano structured silica particles that are covalently bonded to an epoxy-based polymer matrix. The roughened surface is chemically modified with a layer of n-octyltriethoxysilane. The morphology of the silica with micro-nano hierarchical structure was observed by SEM. Hierarchical structure of silica filled epoxy resin composite exhibits better humidity resistance than the neat epoxy resin. The results show that the hierarchical structure of silica filled epoxy resin composite is suitable for electronic packaging in humid environment. [C104]

### "Characterization of the creep constitutive behavior of SnAgCu solder in flip chip joints from the indentation creep testing"

In this paper, creep behavior of the lead-free SnAgCu solder alloy after reflow process was investigated by use of Nano Indenter XP technology. Based on the steady-state power law creep relationship, the creep strain rate sensitivity exponent was determined from the indentation creep testing using dimensionless analysis method. Then, combining numerical simulation with dimensional analysis, the value of  $C$  in creep constitutive equations are obtained using search method. So power law creep constitutive equations for micro-solder joint can be obtained. The creep time-creep displacement curves calculated from numerical simulation match well with those measured from indentation experiment in room temperature, the results indicating that the steady-state creep model is valid in describing the creep mechanical properties of solder joints. [C105]

### "Study on adhesive reliability of low-temperature sintered high power LED modules"

Low temperature sintered nano-silver paste becomes a potential alternative in green electrical packaging because of its higher thermal and electrical conductivity than conventional solders. It can be used for connected chips that require high temperature operation, such as high power LED and power electronics modules, etc. During service, alternating shear strain, even thermal fatigue failure will occur due to thermal expansion coefficient mismatch of chip and substrate. Therefore, it is necessary to study the reliability and failure mechanism of low temperature sintered nano-silver joint. In this study, loading-control shear fatigue tests, temperature cycling and hygrothermal aging tests were conducted on sintered nano-silver paste connected LED modules, through which we made an initial exploration on the mechanical reliability and failure mechanism of this new type of interconnection material. [C106]

### "Carbon nanotube enhanced thermally and electrically conductive adhesive for advanced packaging"

A comprehensive investigation has been carried out to develop nano-adhesive by studying the influences of post-treatment of carbon nanotube (CNT), dispersing parameter, CNT content and matrix on the adhesive performance. It has been found that both thermal resistance ( $R_{th}$ ) and volume resistance reduced greatly by incorporating CNT into the epoxy. The uniform distribution of CNT has been achieved by optimizing the dispersion parameter. It has been demonstrated that the  $R_{th}$  decreased with increasing the CNT content. The formation of the network of CNTs in the matrix, the loading grade of the filler, the manufacture process and the properties of the matrix exert an important influence on the thermal, electrical and mechanical properties of the adhesive. The adhesive made of post-treated CNT showed lower thermal resistance than any other non-treated CNT. The low thermal resistance, 3.5Kmm<sup>2</sup>/W at bondline thickness 10µm was achieved. TGA study gave the degradation temperature from 330°C to 470°C, depending on the matrices used. The thermal shock cycling was performed at temperature from -55°C to 150°C and no delamination was observed. The volume resistance,



4.51410-30hm-cm has been measured and post-curing further decreased the resistance. In addition, viscosity, glass transition temperature and screen printability have been studied. The glass transition temperature was evaluated to be higher than the unloaded epoxy resin. The highest glass transition temperature, 270°C was achieved by finding out the desirable composition where the CNTs and epoxy were well incorporated. Screen printability is another important property of adhesive. The adhesive could be screen printed onto substrate and the uniform dispersion of CNT made it possible to print the adhesive either on large area or in fine structure for different application. The pot life has been determined by measuring the change of the viscosity with the exposing time in air. In order to study the adherence strength, a copper foil was bonded with ceramic substrate using the newly developed adhesive and then peeled off. The adhesive remained on both sides of Cu and ceramic, showing strong adhesion to metal and ceramic as well. A constant peeling strength along the length direction, 4N/mm has been measured. The new application of the CNT-enhanced adhesive has been studied too.

[C107]

#### "Mechanical characterization of the IMC layer by using Nano-indentation tests"

The IMC has become an important criterion when assessing the reliability of portable electronics. The quality of solder joints directly determines the drop-impact reliability of the product. As a structural member of the electronic product, IMCs are used to connect the solders and the associated printed circuit board by a proper joining technique such as the surface mount technology (SMT). Inter-metallic Compound, which is between lead-free solder Sn3.0Ag0.5Cu and Cu-pad, were measured by using nano-indentation tests, while the load-displacement curves, displacement-elastic modulus curve and displacement-hardness curves were recorded. Modulus and hardness of these IMCs were characterized by Nano-indentation CSM from plan view in this study. Basing on these experimental data, The calculation of modulus and hardness for IMC layers was based on nano-indentation CSM test results and was compared with reported results. [C108]

#### "Experimental research of micro-channel cooler"

With the continuously decreasing size and constantly increasing integration of IC chips, the heat flux is increasing rapidly. Many enhancements are proposed in order to increase the thermal conductivity of micro-channels including nano-fluids, special shapes, and two phase flows, etc. This paper explores a new test system to measure the heat transfer performance of micro-channel cooler. Considering the accuracy of the test, materials with lower thermal conductivity is selected to package the cooler, and a DAQ system is set up to collect the test data. It's found that in most cases laminar flow occur, and some relationships between temperature, pressure, heat flux and mass flow are obtained. And this research proceeds as foundation for the further research work. [C109]

#### "Design theory and fabrication process of 90nm unipolar-CMOS"

The innovative basic punchthrough theory for the unipolar-CMOS is for the first time presented and the first unipolar-CMOS inverter has been fabricated successfully by using the 90nm technology developed in Taiwan National Nano Device Lab. The severe scaling issues with silicon can be further use and no more serious. The low-performance P-FETs can be get rid of and switch much faster both for high-electron-mobility III-V and CNT based technology. According to the measurement two empirical models, the new concept of the load line drawing and the optimum design of the unipolar-CMOS are also illustrated. Employing them for unipolar-CMOS design, the desired high performance ultimate SOC and SOP system can be easily realized. [C110]

#### "Power-on-reset circuit with power-off auto-discharging path for passive RFID tag ICs"

A nano-power power-on-reset (POR) circuit for passive RFID tag is presented in this paper. It is applied to a passive UHF C1G2 RFID tag ICs fabricated in a 90-nm CMOS technology. Measurement results confirm that the generated POR pulse signal is accurate and reliable due to the proposed hysteresis-comparator structure and power-off auto-discharging path. Moreover, the POR circuit consumes 150-nA quiescent current only.

[C111]

#### "Copyright page"

The following topics are dealt with: emerging nano-circuits and systems; analog A/D converters; embedded electronics; computer arithmetic and clock circuits; biomedical and bio-inspired engineering systems; deep submicron design and automation; memory design and techniques for managing process parameter variations; RF, microwave and optical systems; amplifiers; low-power design and design automation; algorithms and hardware techniques for high performance digital circuits/systems; MEMS and bioengineering; converters, sensors and modeling; communications and wireless systems; image processing and multimedia systems; nonlinear systems and neural networks; RF built-in-self-test (RF-BiST) and RF built-in-self-calibration (RF-BiSC)



techniques; arithmetic circuits; frequency compensation for multi-stage amplifiers and low-dropout voltage regulators; low power digital circuits/systems; programmable logic, VLSI, CAD and layout; nanoelectronics and nanotechnology; control systems, robotics and power electronics; and energy efficient embedded systems.

[C112]

### "Towards an interactive knowledge transfer-The non-destructive evaluation knowledge-based system"

The "Center for Non-Destructive Nano Evaluation of Electronics Packaging" (nanoeva®), a common organization of the Fraunhofer Institute for Non-Destructive Testing, Dresden branch (IZFP-D) and the Electronics Packaging Lab (IAVT) with its Centre for Microtechnical Manufacturing (ZµP) of the Dresden University of Technology, focuses its activities in development and application of new non-destructive evaluation (NDE) techniques jointly with the electronics industry and in transfer the knowledge to colleagues in industry and research institutes. The actual broad variety of the available techniques like x-ray diagnostics, ultrasonic microscopy, atomic force acoustic microscopy, scanning electron microscopy, optical inspection techniques, geometric laser measurement, surface characterization etc. bases on the collaboration and knowledge transfer between various scientific specialists. To advance the value of interactive knowledge transfer, nanoeva® decided to build-up the infrastructure for the implementation of a sustainable storage and access to a consolidated NDE knowledge-based system as an additional pillar within the competence center. [C113]

### "Application of silver nanoparticles to improve wettability of SnAgCu solder paste"

Due to European regulations (RoHS) lead-free solder pastes have been commonly used in electronics assembly for printed wiring board (PWB) assembly in surface mount technology applications. The most popular are pastes with SnAgCu (SAC) alloy family. It is well known that some of material properties can be changed by addition of nanoparticles. Our research objective is trying to modify the lead-free solder paste wettability by silver nanoparticles. The nanoparticles of silver with different grain sizes were added to the own developed SAC solder paste. We found improvement of the wetting results of investigated "nano solder pastes" on copper substrate depending on temperatures (220, 230, 240, 250°C) as well as on nano silver grain size. Using SEM microscope and EDS spectroscopy we found that silver nanoparticles provoke differences in the microstructure of solder joints as well as create the IMC rod and scallop form layers with different thickness after reflow process. [C114]

### "High performance digital circuit design using Ballistic Nano-electronics"

With modern CMOS technology already close to approaching the limits of lithography, serious doubts exist over the ability of the standard CMOS ASIC design approach to deliver the required complexity, integration density and computational capability. This has prompted increasing research in novel non-CMOS devices to address the issues of modern day computing. This paper presents an investigation into the feasibility of recently proposed Ballistic Deflection Transistors (BDT) for future generation Terahertz computing. By means of Monte Carlo modeling we show that the device is capable of entering into the THz range at room temperature. We propose an analytical expression which can be used to describe an accurate behavioral model of BDT in Verilog-A, to serve as the first generation Predictive Technology Model for the Ballistic Deflection Transistor. We conclude presenting structures for various logic gates developed using the BDT. [C115]

### "Silicon sensor with high sensibility from 200 to 1100 nm using embedded silicon nano-particles"

Silicon photodetectors have a limited response in the visible range. However, the silicon technology is currently the most important. Then there is the need to develop silicon sensors that are able to detect radiation in different ranges. In this paper, a sensor, that uses Si nano-particles, sensible in the whole range from 200 to 1100 nm is characterized in both DC and AC signal. A discussion is done that relates the sensibility of the sensor with the SRO characteristics. [C116]

### "A composition-aware model for unreliable circuits"

As the integrated circuit geometries shrink, it becomes important for the designers to take into consideration the reliability of the circuits. Different techniques can be used for reliability calculation or estimation. Some of the techniques are accurate but time-consuming while others are quick but may not be accurate enough. This work presents a model for calculating reliability (represented by probability of failure) as a function of circuit composition, such as, number of inputs and numbers of different types of gates, etc. The model is based on data collected from the simulations of a large number of combinational circuits. [C117]

### "QCA design and implementation of SRAM based FPGA Configurable Logic Block"



This paper presents the design and simulation of a Configurable Logic Block (CLB) using the Quantum-Dot Cellular Automata (QCA) technology. The modeling, implementation, and successful simulation of a CLB slice for a nano quantum FPGA are discussed. We have drawn comparisons with various FPGA architectures at the quantum level and optimized the proposed architecture with respect to area and latency. The design is modeled using standard QCA cells with multiple layers for reliable interconnect crossovers. The design of the CLB is implemented and simulated using the QCA Designer software tool. [C118]

#### **"Approaching green electronics: Power efficient arithmetic in nano-scale CMOS"**

Manufacturers of PCs, TVs, game consoles, mobile phones, etc. are facing new demands on their products the coming decades. Such products must fulfill new requirements to be classified as green electronics. Green electronics have a wide sense regarding toxic chemicals, reuse, recycling etc. Furthermore, the energy consumption is also an important part in the perspective of the climate change and global warming. Reducing the dynamic energy consumption have for a long time been a focus for battery or cooling reasons. However, today we face new challenges; the static energy consumption is becoming dominant, in future technologies. To be able to call future electronics green, great attention must be paid on the total power consumption, not at least the static power consumption. This paper focuses on leakage reduction at architecture and arithmetic level. A methodology for considerable reduction of the static power consumption is shown on filter architectures. [C119]

#### **"Improving surface bipolar activity in thin gate oxide DE-NMOS-A critical HV I/O protection element for nano-meter scale technologies"**

Drain Extended (DE-NMOS) ESD protection devices exhibit low ESD performance due to poor bipolar action. The purpose of this work is to investigate the role of surface bipolar phenomenon in 90nm DE-NMOS, which triggers failure due to bipolar turn-on, and next study the impact of adding source/drain resistors on their ESD robustness. [C120]

#### **"Comparing the robustness of fault-tolerant enhancements when applied to lookup tables and random logic for nano-computing"**

New challenges are arising in the design of computer systems with the emergence of new nanometer-scale devices and sophisticated fabrication techniques. Unfortunately, the yield, reliability, and drive characteristics of these new deep-submicron and nano-scale devices are different from the corresponding characteristics of conventional CMOS devices. It is expected that future circuit technologies will have substantially higher defect densities and dynamic fault rates. There is no consensus yet on which technology will be selected and which of the traditional logic designs has an advantage for fault tolerant nano-computing. In this work, we compare the robustness of several fault-tolerant approaches applied to lookup table design and random logic design for a wide range of fault rates. Implementing fault tolerance in a circuit using TMR and Hamming and Hsiao error correcting codes with a lookup table design style gives better fault coverage compared with a random gate design style. TMR is the best fault-tolerance technique when implemented using the lookup table design. However, TMR was the worst technique for fault rates greater than 0.5% when implemented using random logic design and no gate level is fault free. [C121]

#### **"Energy-efficient techniques for circuit design in network-on-chip platforms"**

Advanced network-on-chip (NOC) designs using nano-scale technologies face a number of challenges, especially for great amount of energy consumption in switch fabrics and link wires. In this paper, some energy-efficient techniques are presented for circuit design in network-on-chip platforms, including low-power and variation-tolerant link wires, adaptive congestion-aware routing and asynchronous two-level FIFO buffers. Energy-efficient and reliable link wires are provided by a novel self-calibrated low-power coding and voltage scaling interconnection architecture. This approach makes the NoC applications tolerant of transient malfunctions and realizes energy efficiency. Additionally, an adaptive congestion-aware routing is proposed to reduce the average latencies by avoiding the congestion conditions and distributed hotspots. Moreover, an asynchronous two-level FIFO buffer can reduce energy consumption compared with that of synchronous two-level FIFO buffers and conventional asynchronous output buffers. [C122]

#### **"Nano-technology aware investigations on fault-masking techniques in the presence of high fault probabilities"**

Nano-architectures are promising alternatives for current CMOS technology, which is facing serious challenges for further down-scaling. However, high failure rates-compared to the conventional CMOS process-lead to multiple faults during lifetime operation of nano-architectures. In this paper, we investigate the outcome of



traditional fault-masking techniques in the presence of high fault probabilities. Redundant codes and circuit structures are evaluated in a generic way, using stochastic methods. The original goal was to provide a means to decide, under which conditions, which fault-masking techniques are worthwhile. Our results, however, suggest, that these techniques require extremely low fault rates and/or cause extraordinarily high additional cost. [C123]

#### "Electrochemical transducer utilizing nanowires surface"

Recent research showed the availability of atmospheric pollutant monitoring using a gas sensor with nanostructured surface of sensing electrode which can be prepared through an anodization process. The use of anodization technique for obtaining oxide porous material which can be used e. g. as nano-template was firstly reported in the work of Masuda et al. The aim of presented work is the fabrication of Au nanowires further modified with TiO<sub>2</sub> layer to improve the electrode sensing properties due to increasing its specific surface. [C124]

#### "Nanocrystalline silicon thin film transistors"

Summary form only given. The evolution in materials and process fabrication technologies is posing new challenges and application areas in large area electronics. A driving force in this evolution is silicon thin film technology. Interest in thin film silicon extends well beyond the active matrix liquid crystal display and stems from a variety of desired technological features including low temperature manufacturing with few constraints on the substrate size, material, or topology. More recently, the extension of the technology to plastic substrates has received considerable attention. Interests on plastic is being driven by the need for lightweight, unbreakable, and eventually foldable screens for displays and imagers, along with a plethora of new generation applications ranging from media to bio-medicine. Although thin film silicon, by virtue of material structure, does not enjoy the same electronic properties, such as speed and current drive capability compared to crystalline Si, it is currently being challenged with new material and device structures that can meet performance requirements, particularly that of active matrix backplanes for a new generation of displays and imagers. This talk will review precisely these challenges, and address device and materials-related issues from the standpoint of scaling channel lengths and compacting transistor area through use of vertical transistor structures, and nano-structuring thin film silicon for high mobility, stability, and drive current, and more importantly, CMOS realization for eventual system-on-panel integration at sub-150°C for plastic compatibility. [C125]

#### "Parametric instability of mobile elastic gate in tera- and nano- high electron mobility transistor"

Effective excitation of the micro and nanometer-size resonators has number of applications at various fields of science and technology. In particular, they include wireless telecommunication technologies, high sensitivity measuring systems, quantum information processing devices. At the present report we consider the mechanical cantilever oscillations parametric excitation that serves as the gate electrode of a high electron mobility transistor (HEMT). The parametric coupling between the mechanical resonator (cantilever) and the oscillations of two-dimensional electron gas (2DEG) with high electron mobility is considered. In the capacity of the mechanical resonator a clamped nanobeam or a carbon nanotube might be used. 2DEG can arise in GaAs/AlGaAs heterostructures on the basis of which high electron mobility transistors (HEMT) are produced. [C126]

#### "A 0.063 $\mu\text{m}^2$ FinFET SRAM cell demonstration with conventional lithography using a novel integration scheme with aggressively scaled fin and gate pitch"

We demonstrate the smallest FinFET SRAM cell size of 0.063  $\mu\text{m}^2$  reported to date using optical lithography. The cell is fabricated with contacted gate pitch (CPP) scaled to 80 nm and fin pitch scaled to 40 nm for the first time using a state-of-the-art 300 mm tool set. A unique patterning scheme featuring double-expose, double-etch (DE2) sidewall image transfer (SIT) process is used for fin formation. This scheme also forms differential fin pitch in the SRAM cells, where epitaxial films are used to merge only the tight pitch devices. The epitaxial films are also used for conformal doping of the devices, which reduces the external resistance significantly. Other features include gate-first metal gate stacks and transistors with 25 nm gate lengths with excellent short channel control. [C127]

#### "Silicon on replacement insulator (SRI) floating body cell (FBC) memory"

A 15-nm node floating body cell (FBC) memory was demonstrated utilizing silicon on replacement insulator (SRI) technology on bulk substrate. Highly selective SiGe etch and nano-scale anchors enabled the fabrication of silicon on thin replacement oxide of 12 nm. The memory characteristics show a memory signal of 7  $\mu\text{A}$  and disturb retention time of 20 ms for a 51-nm gate length and 77-nm width device. This is the best FBC memory performance reported on bulk substrate. [C128]



### "A probabilistic approach for on-line positioning in nano manipulations"

Nanomanipulation and nanoassembly using atom force microscopy (AFM) is a potential and promising technology for nanomanufacturing. Precise position of the tip of AFM is important to increase the accuracy and efficiency on fabricate complex nanostructures. However at the nano-scale, it is difficult to acquire the tip position expressed by the coordinate in real time due to PZT nonlinearity and thermal drift through the general measure. In this paper, a probabilistic approach incorporating a Kalman filter based localization algorithm is introduced into the on-line estimation of the tip position expressed by probability distribution known as probability density function. A probabilistic motion model of AFM tip is introduced that consists of a PZT dynamic model based on the Prandtl-Ishlinskii (PI) model, and motion error distribution obtained from calibration experiments. An observation model by using a local scanning algorithm is proposed and the change of uncertainty distribution on scanning landmarks, e.g. nano-particles, near the target position is analyzed. Some experiment results are included for showing the motion error distribution and a simulation result is presented to illustrate the validity of the proposed method. [C129]

### "High-mobility Si1-xGex -channel PFETs: Layout dependence and enhanced scalability, demonstrating 90% performance boost at narrow widths"

This paper is the first to provide a comprehensive study on the layout dependence of scaled Si1-xGex-channel pFETs. Drive current enhancement up to 90% is demonstrated for Si0.55Ge0.45-channel pFETs with LG= 35 nm and EOT = 0.9 nm when the transistor width (W) is scaled from 10  $\mu$ m to 110 nm. This is attributed to a change in channel stress from biaxial compressive at large W to the more beneficial longitudinal uniaxial compressive stress at narrow W. These results are confirmed by both Nano-Beam Diffraction and TCAD analysis. Moreover, LG= 35 nm Si0.55Ge0.45pFETs show 20% linear current enhancement for Length-Of-Diffusion (LOD) scaling below 200 nm. Both W- and LOD-scaling work favorably for Si1-xGexpFETs, as a consequence they are excellent candidates to be used in future HP CMOS technologies. [C130]

### "GaAs nano-pillars for solar power absorption: Electromagnetic characterization"

The characterization of GaAs nano-pillars in the optical frequency range was investigated using HFSS. Important parameters such as optical material properties were compiled and organized to allow accurate simulation of GaAs nano-pillars to observe total reflection in comparison to flat GaAs pn-junction. This characterization exercise was essential in providing a platform for further investigation of these nano-pillars. It is now possible to utilize these simulations to optimize the critical pillar dimensions such as pillar height, diameter, and spacing by introducing techniques such as Particle Swarm Optimization (PSO) to help improve and potentially exceed the efficiency of current GaAs solar cell technology. [C131]

### "Low-cost antennas for mm-Wave sensing applications using inkjet printing of silver nano-particles on liquid crystal polymers"

This paper realizes the low-cost mm-Wave antennas using inkjet printing of silver nano-particles. It is widely spread that fabrication of mm-Wave antennas and microwave circuits using the typical (deposit/pattern/etch) scheme is a challenging and costly process, due to the strict limitations on permissible tolerances. Such fabrication technique becomes even more challenging when dealing with flexible substrate materials, such as liquid crystal polymers. On the other hand, inkjet printing of conductive inks managed to form an emerging fabrication technology that has gained lots of attention over the last few years. Such process allows the deposition of conductive particles directly at the desired location on a substrate of interest, without need for mask productions, alignments, or etching. This means the inkjet printing of conductive materials could present the future of environment-friendly low-cost rapid manufacturing of RF circuits and antennas. [C132]

### "Ubiquity: Micro to Macro Ecosystems?"

Specialists usually interpret the defining keywords of ubiquitous computing "anywhere, anytime" as "any geographical place at any moment of a given day". Our alternative interpretation "at any scale over the years" offers a complementary conceptual framework covering microscopic to macroscopic ecosystems. We introduce nano-bots, implants, smart artefacts, wearable computers, domestic robots, smart buildings, smart cities (aka u-cities), smart territories, and interplanetary systems then analyse their energetic and informatory relationships. We conclude that technologies linked to non-human scales are neglected, that convergence is insufficient to guide ubiquity, that environmental factors endanger resulting ecosystems, and that these ecosystems lack critical organisms, links and mechanisms. We accordingly suggest thirteen foundations for viable and healthy ecosystems based on ubicomp. They involve guiding concepts, ubiquitous virtual reality, sustainability, climatic factors, resource optimization and management, waste processors, open standards, features (anonymity, redundancy, simplicity), and mechanisms (provision, regulation, support) to structure and maintain ecosystem



services useful to humans. [C133]

### "Design and fabrication of a low-power and nanoporous micro-hotplate for chemical sensor applications with high sensitivity"

The paper describes a conceptual platform development, including design, simulation and manufacture in nanoporous biomedical and chemical sensor applications. We exploit anodic aluminum oxidation (AAO) technology to produce an excellent nanoporous surface for fast gas detection, and combine with micro-electromechanical systems (MEMS) process to implement micro-sized devices with low power consumption. In order to compare the substantial difference between nanoporous and conventionally flat silicon oxide surfaces, a finite element method (FEM) tool such as ANSYS was employed to carry out coupled-field electro-thermal simulations and verify the low-power features of nanoporous device design. Finally, we succeed to fabricate nanoporous devices as a superior CMOS-MEMS platform for promising applications in bio-chemical and medical fields. [C134]

### "Indirect compensation techniques for three-stage fully-differential op-amps"

As CMOS technology continues to evolve, the supply voltages are decreasing while at the same time the transistor threshold voltages are remaining relatively constant. Making matters worse, the inherent gain available from the nano-CMOS transistors is dropping. Traditional techniques for achieving high-gain by cascoding become less useful in nano-scale CMOS processes. Horizontal cascading (multi-stage) must be used in order to realize high-gain op-amps in low supply voltage processes. This paper discusses indirect compensation techniques for op-amps using split-length devices. A reversed-nested indirect compensated (RNIC) topology, employing double pole-zero cancellation, is illustrated for the design of three-stage op-amps. The RNIC topology is then extended to the design of three-stage fully-differential op-amps. Novel three-stage fully-differential gain-stage cascade structures are presented with efficient common mode feedback (CMFB) stabilization. Simulation results are presented for the designed RNIC fully-differential three-stage op-amps. The fully-differential three-stage op-amps, designed in 0.5  $\mu\text{m}$  CMOS, typically exhibit 18 MHz unity-gain frequency, 82 dB open-loop DC gain, nearly 300 ns transient settling and 72° phase-margin for a 500 pF load. [C135]

### "IDD scan test method for fault localization technique on CMOS VLSI failure analysis"

One of the fashionable stress test that has been practiced in CMOS VLSI recently is known as IDDQscan test. It has competency to be exercised as a part of failure analysis method in localization latent defect with nano scale geometry, i.e. gate oxide hole. An extension study in this field delivers proficiency on logic circuit diagnostic. Form the results obtained during the experiment, it shows that the IDDscan test can be applied effectively in triggering significant emission spot during anomalous logic transition. [C136]

### "Synthesis of higher-order K-Delta-1-Sigma modulators for wideband ADCs"

As CMOS technology shrinks, the transistor speed increases enabling higher speed communications and more complex systems. These benefits come at the cost of decreasing inherent device gain, increased transistor leakage currents and device mismatches due to process variations. All of these drawbacks affect the design of high-resolution analog-to-digital converters (ADCs) in nano-CMOS processes. To move towards an ADC topology useful in nano-CMOS, the K-Delta-1-Sigma (KD1S) modulator-based ADC was proposed. This paper extends the KD1S to higher order topologies using a systematic synthesis procedure. Second and third order KD1S modulator are designed and simulated to demonstrate the synthesis method. [C137]

### "An ultra-low power ring oscillator for passive UHF RFID transponders"

This paper presents a new two-stage CMOS voltage-controlled ring oscillator (VCO) designed for passive UHF RFID transponders. The goal is to explore the design space for the lowest possible power dissipation. A nano-power VCO capable of functioning as a local oscillator for the transponders is obtained by biasing the delay cells to operate in weak inversion region. Further power reduction is achieved by transistor sizing. Designed in a 90 nm CMOS technology, the proposed circuit generates oscillation signals at 5.12 MHz and consumes only 24 nW with 0.3 V power supply. [C138]

### "Process tool cleanliness for clean manufacturing"

Wafer tool cleanliness specifications are generally accepted for various processes and technology nodes. However, the material and component cleanliness required to meet these wafer tool cleanliness is vague. One reason is the lack of uniformly accepted parts cleanliness tests. This paper reviews and recommends test methods for determining the cleanliness of coupons, first articles and production parts. [C139]



### "Low cost microstrip patch antenna array using planar waveguide technology for emerging millimeter-wave wireless communication"

With rapidly increasing demand for bandwidth, and the recent advances in nano-metric Si-based integrated circuit technologies, millimeter-wave (mmW) systems are finding numerous commercial applications, which, unlike military and scientific usages, are extremely cost sensitive. A wide range of applications at mmW frequencies can be found in such area as wireless communications network (60 GHz), automotive radar systems (79 GHz), and passive mmW imaging (91GHz). Microstrip patch antenna (MPA) arrays are known to have advantages of low profile and ease of manufacturing. However, the efficiency of MPAs with large aperture is degraded due to feeding loss. Recently, a low cost, high Q- factor planar feeding scheme using substrate integrated waveguide (SIW) has been reported. The proposed design has promising characteristics including a high radiation efficiency. In this paper, a novel high radiation efficiency SIW-fed MPA array (SIW-MPA) is presented. Single element, series fed linear array 1 Ч 8, MPAs are designed at mmW- frequency range. The numerical results (simulations using HFSS) for the designed antennas are presented to characterize their performances. [C140]

### "Nanostructures of III-V semiconductor for photonic, electronic, and sensing applications back to basics"

With the advancement of technology, the semiconductor materials are fabricated with ever shrinking size in order to reduce space and weight while at the same time benefiting from the improved performance such as high speed and low operating power. Recently found phenomena called, quantum confinement (QC) effects related to semiconductor material reaching the size in nanometer scale, only added to the excitement among researchers in this field around the world. Among notable effects of QC in nano-sized semiconductor is the enlargement of the bandgap due to the folding of the Brillouin zone. A few notable techniques that have been developed along this line are Metal Oxide Chemical Vapor Deposition (MOCVD), Molecular Beam Epitaxy (MBE), and Liquid Phase Chemical Vapor Deposition to name but a few. However these machines are very expensive to operate especially for large scale production. This obstacle has prompted researchers to find other alternatives for cheaper production cost but trying to maintain the quality of the grown nanostructures for high performance devices. Those techniques are the ones which had been used before the QC effects are found. In this talk we are revisiting one of the low cost conventional techniques to grow high quality III-V nanostructure on Si substrate, that is electrochemical etching and deposition. This technique relies on the type of electrolyte, electrical current, temperature, time and ambient light. The quality of the grown layers is studied using SEM, PL, Raman and XRD Spectroscopy. The potential application of the grown layers in light emission, light detection, and gas sensing is also discussed. [C141]

### "Heterogeneous integration: Beyond CMOS-coping with variability at the end of the CMOS roadmap"

By 2020 it is very likely that nano-CMOS will reach the end of the scaling roadmap. Current 32nm CMOS production technology already is hampered by large variations in electrical parameters, with impacts on performance predictability, power consumption limitations and design closure for complex systems. Heterogeneous integration is the roadmap to lower cost and yet more advanced and innovative functionalities on silicon, with new and more manageable challenges. There will be no end nor a definite demise of silicon technology. While there are uncertainties as to what will be the show-stoppers for the down-scaling of nano-CMOS, there is a large number of transitional and compatible to CMOS technologies that will be more important than just 2-D scaling. This talk discusses variability among other limitations that bring the end of 2-D scaling and also proposes a likely scenario for hardware technology evolution and related challenges for integrating systems in the next 20 years. The scenario beyond the end of the roadmap is drawn, in which heterogeneous integration at the device level as well as at the system level will bring new frontiers to the ULSI era of tera-scale integration. Transitional technologies like 3-D integration by through-silicon vias, carbon-based electron devices, and even magnetic materials devices will co-exist and be built upon a basic CMOS-like technology platform. [C142]

### "Study of proportion and fuzzy control method upon precision micro-flow valve"

Micro-titration technique, based on the condition of precision and ultra-precision, is an important part in Modern Micro-flow control technology and is also one of key technologies in Nano technology in 21stFrontier Technology. In this paper we built a precise flow valve model driven by piezoceramics and then drive the flow valve spool using the inverse piezoelectric effect of piezoelectric ceramics to control the size of precise flow valve and model building based on mathematical relationship among the driving power, the output displacement and the output flow. In view of the non-linearity, hysteresis, creep and other properties of piezoelectric ceramics



affecting the control accuracy and control of complex, it proposed a proportional fuzzy control method and obtained more desirable results comparison in the commonly used control methods. [C143]

### "Crystalline Ge<sub>1-x</sub>Sn<sub>x</sub> Heterostructures in Lateral High-Speed Devices"

This paper describes an approach to manufacture high-speed Germanium MOSFETS with strained channels made from Ge<sub>1-x</sub>Sn<sub>x</sub>-alloys while embedding the needed technology process flow into a virtual knowledge management environment based on a virtual nano electrical lab. [C144]

### "Si Nanostructures Embedded into Crystalline Rare Earth Oxide Matrix for Opto and Nano Electronic Devices"

We describe a novel approach to grow Si nanostructures embedded into crystalline rare earth oxides using molecular beam epitaxy. By efficiently exploiting the growth kinetics during growth one could create nanostructures exhibiting various dimensions, ranging from three dimensionally confined quantum dots to the quantum wells, where the particles are confined in of the dimensions. The crystalline rare earth oxide that has been used in this study is epitaxial gadolinium oxide (Gd<sub>2</sub>O<sub>3</sub>). The room temperature quantum confinement effects characterized by the strong intensity and narrow photoluminescence peak in an array of Si quantum dots embedded in Gd<sub>2</sub>O<sub>3</sub>, indicates high crystalline quality and narrow size distribution range of quantum dots. The Si quantum dots with dimension about 3-5 nm exhibited quantum confinement, which was observed in the photoluminescence and photoionization studies. The embedded Si-nanoclusters exhibit excellent charge storage capacity with competent retention and endurance characteristics, and demonstrate their potential in future nonvolatile memory devices. [C145]

### "Quantum Star Graphs and Spectral Branching Filter"

The analysis of quantum star graph, a mathematical model of quantum-wire based single electron device, is presented. It is shown that the proper connection condition of quantum wave functions at the node can be understood as combinations of  $\Gamma, B_i$  and  $\Gamma, B_i'$  interactions between all pairs of lines. We examine the case of  $n = 2$  and  $n = 3$ , and show that the identification of  $\Gamma, B_i$  and  $\Gamma, B_i'$  components enables the designing of quantum spectral branching filters. [C146]

### "Dip Pen Nanolithography® (DPN®) and the Deposition of Multiple Materials in Nanopatterning"

Multiplexed patterns of hydrogels and phospholipids with fluorescent dyes are accomplished by dip-pen nanolithography® (DPN®). For example, four different dyes-labeled hydrogel dot arrays are DPN®, patterned within 50  $\Gamma, B_i$ — 50  $\Gamma, B_i m^2$  area, and two different dyes-doped phospholipids dots and letters with less than 1  $\Gamma, B_i m$  line-width are also DPN®, patterned. We demonstrate that multi-ink patterns with precise alignment are able to be printed by DPN®, within a micron-scale. Moreover, this multi-ink DPN®, patterning methodology can be extended to delicate bio-materials printing in a subcellular scale with accurate positioning control. [C147]

### "Magnetoresistive Detection of Magnetic Beads and Nanoparticles: Spatial Resolution and Number Sensitive Detection"

The detection capability of magnetic beads and nanoparticles by tunneling magnetoresistance sensors is analyzed in a finite element framework. The limitations for single particle detection and the determination of the particle position are investigated. It will be shown how varying the geometrical sensor design may readily be employed to adjust the setup to a specific measurement task. Especially, we show up strategies increasing the sensitivity by introducing magnetically soft areas. Further, number sensitive detections are discussed and the influence of dipolar particle coupling on the measured signal is calculated. [C148]

### "Atomic Force Microscopy Helps to Develop Methods for Physical Detection of Cancerous Cells"

Humans are still far from defeating cancer. Early detection of cancer will decrease fatality from this disease. Traditional methods of identification of cancerous cells are mainly based on regular techniques used in biology, such as visual identification of malignant changes, cell growth analysis, specific ligand-receptor labeling, or genetic tests. After many years of research, these methods are still either insufficiently accurate or require a lengthy complicated analysis. It has been recently shown that the atomic force microscopy (AFM) method can be useful in the search for alternative methods for a reliable detection of cancer cells. Here we describe the atomic force microscopy (AFM) study of malignant and normal cells cultured from human cervix. Studying adhesion of AFM probes to both of these types of cells, we found that the adhesion can be statistically different. This finding allows us to propose two novel methods for detection cancer cells by using fluorescent silica beads. The



methods show high sensitivity to detect cancer in-vitro. Nevertheless, more statistical data will be needed to determine the actual accuracy of the methods. [C149]

### "Optoelectronic Devices Based on the Directed Self-Assembly of Single InAs/InP Quantum Dots"

Optoelectronic devices based on single, self-assembled semiconductor quantum dots are attractive for applications in secure optical communications, quantum computation and sensing. In this paper we show how it is possible to dictate the nucleation site of individual InAs/InP quantum dots using a directed self-assembly process, to control the electronic structure of the nucleated dots and also how to control their coupling to the optical field by locating them within the high field region of a photonic crystal nanocavity. For application within fiber networks, these quantum dots are targeted to emit in the spectral region around 1550 nm. [C150]

### "Fabrication of Thick Insulating Membrane Embedded in Si Substrate"

The present paper is devoted to the description of a fabrication process of thick (tens of micrometers) insulating SiO<sub>2</sub> membrane embedded in a c-Si substrate. The membrane processing consists of total thermal oxidation of trenches, which were preliminary etched on front side of the substrate, conformal deposition of dielectric layer for SiO<sub>2</sub> trenches closing and selective etching of c-Si from back side of the substrate. The proposed process provides high accuracy of membrane thickness control and can be used in monolithic integration of dielectric based passive components with active semiconductor elements. Measurement results demonstrate that thermal insulation similar to that of glass substrate can be reached. [C151]

### "Combination of Boundary Singularity and Direct Simulation Monte Carlo Methods for Nano-scale Flows"

A novel hybrid method combining the continuum approach based boundary singularity method (BSM) and the molecular approach based direct simulation Monte Carlo (DSMC) is developed and then used to study viscous fibrous filtration flows in the transition flow regime. This approach may be useful for modeling of detection and signaling in micro-fluidic sensors. The DSMC is applied to an annular region enclosing the solid fiber and the BSM is employed to the entire flow domain. The parameters used in the DSMC and the coupling procedure, such as the number of simulated DSMC particles, the cell size and the size of the coupling zone are determined. It is observed that in the partial-slip flow regime the results obtained by the hybrid BSM-DSMC method match the ones from the BSM combined with the heuristic partial-slip boundary conditions. For higher Knudsen numbers, the difference in pressure drop and velocity is significant. The developed hybrid method is then parallelized by using MPI and extended for multi-fiber filtration flows. The multi-fiber filter flows considered are in the partial-slip and transition regimes. The proposed combined continuum and molecular methodology can incorporate surface chemical reactions and the electromagnetic forces in the DSMC procedure for Knudsen layer. [C152]

### "On the Weakness of One-Way Quantum Pushdown Automata"

In general, quantum computation models are expected to be more powerful than classical counterparts. However, sometimes this is not the case. It is known that there exists some regular language which one-way quantum finite automata and one-way quantum counter automata cannot recognize. This is due to the restriction of reversibility which quantum models must satisfy. Thus, it is an interesting question: what kinds of quantum models suffer from/overcome the restriction? To tackle this problem, we focus on (empty-stack acceptance) one-way quantum pushdown automata, and show that there exists a regular language which one-way quantum pushdown automata cannot recognize. This implies adding a stack to one-way finite automata cannot overcome the restriction of reversibility if we adopt empty-stack acceptance as the acceptance mode. [C153]

### "Investigation of Double-Chamber Series Valveless Micropump: An Analytical Approach"

We describe an analytical study of the characteristics of a double-chamber series valveless micropump using a one-dimensional non-linear model. We derive a closed-form expression for relationship between the mean volume flux, pressure difference and measurable characteristics of the pump. To first order, the results show the linear decrease of the volume flux with the pressure difference, which is consistent with other types of valveless pump configurations. [C154]

### "Schmidt Operator Norms and Entanglement Theory"

We discuss the family of operator norms recently investigated in and some of their implications in quantum information. We referred to these norms as Schmidt norms since they derive from the Schmidt decomposition theorem for quantum states. These norms find applications to central problems in quantum information, including



the problem of determining  $k$ -positivity of linear maps and entanglement witnesses, and finding bound entangled non-positive partial transpose states. [C155]

### "YinYang Bipolar Quantum Entanglement-Toward a Logically Complete Quantum Theory"

Based on YinYang bipolar relativity a complete non-linear bipolar symmetrical logical theory for coherent quantum interaction is presented that leads to equilibrium-based logically definable causality for quantum entanglement, teleportation, and cryptography with quantum-digital compatibility and an explanation to the hidden variable in the EPR paradox. It is shown with simulation that bipolar teleportation is theoretically possible the first time ever without conventional communication between Alice and Bob, and bipolar cryptography enables the unique feature of bitwise encryption. [C156]

### "Study of the Wigner Function Computed by Solving the Schrödinger Equation"

In this work, we compute the Wigner distribution function from wavefunctions generated by solving the Schrödinger equation. Our goal is to propose an avenue of research that may help better understand certain limitations of Wigner transport equation solvers, such as negative charge densities or limited charge drop-offs in presence of potential barriers. We evaluate the numerical accuracy required by the Schrödinger solver to compute the Wigner function and compare the performance of an analytic and a numerical solver applied to a constant potential profile, as well as to single- and double-barrier structures. Finally, we use the Schrödinger solver to better understand certain conditions to be applied to Wigner transport equation solvers, namely the minimum contact length and  $k$ -grid range. [C157]

### "The Hidden Subgroup Problem for Generalized Quaternions"

The hidden subgroup problem is a pivotal problem in quantum computation since it reflects the structure of tasks for which quantum algorithms significantly outperform classical algorithms. In this paper, a quantum algorithm that solves the hidden subgroup problem over the generalized quaternion group is developed. The algorithm employs the abelian quantum Fourier transform and Kuperberg sieve to reveal the hidden subgroup. [C158]

### "Experimental Sub-shot Noise Quantum Imaging versus Differential Classical Imaging"

Sub-Shot Noise quantum imaging is a novel quantum method allowing in principle to recover the image of a weak absorbing object, even if illuminated by a low photon flux, with a signal to noise ratio larger than classical imaging techniques. Here we present the first realization of a genuine quantum imaging schemes exploiting correlation of twin beams produced by Parametric Down conversion. We compare its performances with respect to the corresponding classical scheme, showing a clear improvement of the sensitivity in the reconstruction of the absorption profile of a weak object. [C159]

### "P3 (power-performance-process) optimization of nano-CMOS SRAM using statistical DOE-ILP"

In this paper, a novel design flow is presented for simultaneous P3 (power minimization, performance maximization and process variation tolerance) optimization of nano-CMOS circuits. For demonstration of the effectiveness of the flow, a 45nm single-ended 7-transistor SRAM is used as example circuit. The SRAM cell is subjected to a dual-Vth assignment based on a novel statistical Design of Experiments-Integer Linear Programming (DOE-ILP) approach. Experimental results show 44.2% power reduction (including leakage) and 43.9% increase in the read static noise margin compared to the baseline design. The process variation analysis of the optimized cell is carried out considering the variability effect in 12 device parameters. A 8 T1B—8 array is constructed to show the feasibility of the proposed SRAM cell. To the best of the authors' knowledge, this is the first study which makes use of statistical Design of Experiments and Integer Linear Programming for optimization of conflicting targets of stability, power in the presence of process variations in an SRAM cell. [C160]

### "Level matrix propagation for reliability analysis of nano-scale circuits based on probabilistic transfer matrix"

As CMOS technology is reaching the nanometer scale, transient and intermittent faults occurrence in logic circuits, which implies a reliability degradation, can no longer be neglected. This paper deals with reliability evaluation which is a critical parameter in circuit design. The proposed method is scalable, iterative and accelerates the reliability analysis. [C161]

### "Limits of bias based assist methods in nano-scale 6T SRAM"

Reduced device dimensions and operating voltages that accompany technology scaling have led to increased



design challenges with each successive technology node. Large scale 6T SRAM arrays beyond 65 nm will increasingly rely on assist methods to overcome the functional limitations imposed by increased variation, reduced overdrive and the inherent read stability/write margin trade off. Factors such as reliability, leakage and data retention establish the boundary conditions for the maximum voltage bias permitted for a given circuit assist approach. These constraints set an upper limit on the potential yield improvement that can be obtained for a given assist method and limit the minimum operation voltage ( $V_{min}$ ). By application of this set of constraints, we show that the read assist limit contour (ALC) in the margin/delay space can provide insight into the ultimate limits for the nano-scale CMOS 6T SRAM. [C162]

#### "Variability resilient low-power 7T-SRAM design for nano-scaled technologies"

High variability in nano-scaled technologies can easily disturb the stability of a carefully designed standard 6T-SRAM cell, causing access failures during a read/write operation. We propose a 7T-SRAM cell to increase the read/write stability under large variations. The proposed design uses a low overhead read/write assist circuitry to increase the noise immunity. Use of an additional transistor and a floating ground allows read disturb free operation. While the write assist circuitry provides a floating ground during a write operation that weakens cell storage by turning off the supply voltage to ground path of the cross-coupled inverter pair. This allows a high speed/low power write operation. Monte Carlo simulations indicate a 200% increase in the read stability and a boost of 124% in write stability compared to a conventional 6T-SRAM design, when subjected to random dopant fluctuations, line edge roughness, and poly-granularity variations. HSPICE simulations of a 45nm 64ГrB—32 bit SRAM array designed using standard 6T and proposed 7T SRAM cells indicate a 31% improvement in write speed/write power, read power decreases by 60%, and a 44% reduction in the total average power consumption is achieved with the proposed design. [C163]

#### "Algorithms to maximize yield and enhance yield/area of pipeline circuitry by insertion of switches and redundant modules"

Increasing yield is important, especially for nano-scale technologies. Also, pipelines are an important aspect of many SoC architectures. In this paper we present new approaches to improve the yield and yield/area of pipeline architectures by using (1) an appropriate number of redundant copies for each module, and (2) sufficient steering logic resources. We present an optimal algorithm of time complexity  $O(n^3)$  that adds redundant modules to an  $n$ -stage pipeline so as to maximize yield. Experimental results indicate that for parameter values of interests, this algorithm also improves the yield/area of the pipeline, especially when the yield for some modules is low. [C164]

#### "Nanoelectronics challenges for the 21st century"

Summary form only given. Leading edge CMOS technologies today are unique examples of nanoscale engineering at an industrial scale. As we celebrate this remarkable achievement of our industry that forms the ever-expanding technology basis of modern society we cannot help but ponder the question of how we can continue to push the envelope of nano-electronics. With the end of Si FET scaling appearing increasingly near, searching for more scalable transistor structures in Si and in Г,Вibeyond-SiГ,Вi solutions has become imperative; from relatively Г,ВieasyГ,Вi transitions to non-planar Si structures, to the incorporation of high mobility semiconductors, like Ge and III-V's, to even higher mobility new materials such as carbon nanotubes, graphene, or other molecular structures. And even further, there are searches for new information representation and processing concepts beyond charge in FETs, as for example, in spin-state devices. Of course, declaring silicon dead is premature at best, and with this in mind I will discuss the challenges and possible scenarios for the introduction of novel nano-electronic devices. [C165]

#### "A novel analytical model of a MEMS vaporizing liquid micro thruster"

Advances in miniaturization of power systems have produced a proliferation of micro and nano satellite designs. Thus, MEMS technology is expanding into increasingly diverse applications. A recent application of the MEMS is in the field of micro propulsion system for miniaturized satellites. Among the various types of MEMS micro thruster developed so far, the vaporizing liquid micro thruster (VLM) has been widely investigated. The theoretical simulation of a VLM entails complex thermodynamic and electro-thermal solution. In the present study, a simple analytical model of a VLM is developed based on extending the similar work carried out by Maurya. The heating process has divided to two stages. Consequently, it is demonstrated that the effective power delivered by the heater remarkably increases the thrust. The results of this analytical study and experimental efforts are found to be in good qualitative agreement. [C166]

#### "Multi-walled carbon nano tubes effects for methane hydrate formation"

Methane hydrate is considered an excellent way of transporting and storing natural gas in large quantities.



However, when methane hydrate is formed artificially, the amount of consumed gas is relatively low due to a slow reaction rate between water and methane gas. Therefore, for the practical purpose in the application, the present investigation focuses on the rapid hydrate formation and the amount of consumed gas by adding MWCNT to pure water. The results show that when the multiwall carbon nano tubes of 0.004 wt% was added to pure water, the amount of consumed gas was about 300% higher than that in pure water and the hydrate formation time decreased at the low subcooling temperature. [C167]

### **"Aggregates of Synthetic Microscale Nanorobots versus Swarms of Computer-Controlled Flagellated Bacterial Robots for Target Therapies through the Human Vascular Network"**

The field of medical nanorobotics exploits nanometer-scale components and phenomena to enable new or at least to enhance existing medical diagnostic and interventional procedures. The best route for such miniature robots to access the various regions inside the human body is certainly the vascular network which is constituted of nearly 100,000 km of blood vessels. The variations in blood vessels diameters from a few millimeters in the arteries, down to ~4  $\mu\text{m}$  in the capillaries with respective important variations in blood flow velocities, lead to significant challenges in the development of a robot relying on a single type of propulsion method while being trackable in the human body. This tracking feasibility in a living body was realized experimentally by integrating magnetic nanoparticles (MNP) capable of creating a net field inhomogeneity that could be detected by magnetic resonance imaging (MRI). In such an environment, dipole-dipole interaction between synthetic microscale nanorobots encapsulating MNP can be used to achieve higher magnetophoretic velocities when subjected to a 3D magnetic gradient force generated by an upgraded MRI platform to allow such aggregated nanorobots to travel in the blood circulatory network. Here, such approach is evaluated against the flagellar propelling thrust force exceeding 4 pN provided by each MC-1 MRI-trackable magnetotactic cells capable of swimming as swarms under computer control in blood vessels. Such artificial and natural approaches are compared with the advantages of each in targeting regions deep in the human body. [C168]

### **"Towards Biosensing Strategies Based on Biochemical Logic Systems"**

Recent advances in biochemical computing, i.e., information processing with cascades of primarily enzymatic reactions realizing computing gates, such as AND, OR, etc., as well as progress in networking these gates and coupling of the resulting systems to smart/responsive electrodes for output readout, have opened new biosensing opportunities. Here we survey existing enabling research results, as well as ideas and research avenues for future development of a new paradigm of digitally operating biosensors logically processing multiple biochemical signals through Boolean logic networks composed of biomolecular reactions, yielding the final output signals as YES/NO responses. Such systems can lead to high-fidelity biosensing compared to common single or parallel sensing devices. [C169]

### **"Selective Capture and Transport of Lipid Vesicles by Using DNAs and Biomolecular Motors"**

We aimed to create an autonomous on-chip system that selectively captures and transports lipid vesicles (liposomes) by using machinery that mimics biological systems. By exploiting DNA hybridization and biomolecular-motor-based motility, we demonstrate that single-stranded DNA-labeled microtubules, gliding on kinesin-coated surfaces, acted as cargo transporters, and single-stranded DNA-labeled cargo liposomes were captured onto the gliding microtubules specified by DNA base sequences. This paper is the first to demonstrate the capture and transport of specified liposomes by using the reconstituted microtubule motility. Our results will help to create biomolecular-motor-based biochemical analysis chips. [C170]

### **"Improving Thermo-mechanical Properties of Styrene Butadiene Rubber Nanocomposites Using Eggshell Bio-filler"**

In this work, styrene butadiene rubber (SBR) nanocomposites were produced at three (5, 10, 15 phr) different levels of loading by using after hatching eggshells (AHES) as bio-fillers and their thermo-mechanical properties were well compared with those prepared by calcium carbonate (CA) nanofillers. AHES fillers were first surface modified by stearic acid and consequently were used while CA nanofillers were coated by provider. Tensile strength and elongation at break data showed considerable improvement through employing AHES nanofillers. In addition, thermogravimetric analysis onto produced samples showed higher thermal stability of samples which were fed with AHES at 5 phr loading than that of CA nanofillers and similar thermal stability of nanocomposites were obtained when 10 and 15 phr of both kinds of nanofillers were used separately. [C171]

### **"Shrunk to nano: The secret language of mechanical communication"**

Force sensation and mechanical communication is vital to many physiological processes. Beginning to decipher



the inner workings of many of the biological actuators (biological nanomotors), mechanotransmitters and nanoscale receivers which convert mechanical stimuli into biochemical signals (mechanotransduction) was made possible by recent advances in nanotechnology. Here we review designs of molecular switches that have evolved in the context of mechanical communication between cells and their environments, whereby cell adhesion sites as well as the fibrous transmission media themselves serve as potent mechano-chemical signal converters. Biological designs enabling mechanical communication will inspire new technologies. [C172]

#### "Single-material MEMS using polycrystalline diamond"

The multi-material MEMS fabrication process often requires a larger number of masks making it more expensive as compared to single-material MEMS (SMM) technology. By varying the doping level in poly-C, semi-conducting, metallic and insulating (undoped) properties are achieved that are needed for poly-C SMM. However, the development of diamond-based SMM technology faces a number of challenges including (a) producing highly-insulating and highly-conducting poly-C films, (b) creating ohmic contacts and (c) patterning by dry etching of poly-C films grown on Si or SiO<sub>2</sub>. These challenges are addressed in this paper. [C173]

#### "Smart drug delivery using electrospun hollow nanofibers"

This paper report on a novel nano-electro-mechanical systems (NEMS) technology-nanoscale coaxial soft smart system (nCS3) that enables radial displacements of a multi-layered coaxial hollow fiber (CHF) and controlled modulations of a nanofluidic flow patterns inside the CHF responding to changes in local environments. The nCS3 has a unique nanostructure that consists of a liquid core and multiple layers of polymer and stimuli-responsive hydrogel. Smart and controlled release of drug molecules is realized using the nCS3. [C174]

#### "From microgripping to nanogripping"

This paper presents a batch microfabrication approach for processing silicon-on-insulator (SOI) wafers to selectively miniaturize device features to sub-micrometers in thickness. The process was demonstrated to construct gripping devices, reducing the thickness of the gripping tips to 1  $\mu\text{m}$  while maintaining a 25  $\mu\text{m}$  thickness for all other structural components. Post processing steps were applied to reduce the intrinsic stress of the material layers resulting from the fabrication process, and focused ion beam (FIB) was used optionally to reshape and sharpen the gripper tips. The new devices demonstrated pick and place of 100 nm gold nano spheres inside a scanning electron microscope (SEM). [C175]

#### "Flow Guidance of Magnetic Particles by Dipolar Particle Interaction"

The authors present a method for flow guidance of magnetic particles in microfluidic devices. Using dipolar particle interactions, the flow of magnetic particles can be manipulated without changing the flow of the carrier liquid. The proposed system operates without any external magnetic gradient fields. Therefore, no electromagnetic components on the microscale are necessary. The method used for the manipulation is deduced from theoretical simulations and tested experimentally. Two different applications are introduced: a particle diverter designed for particle guidance along channel cross-sections and a device for generating a discretized particle flow. [C176]

#### "Analysis and modeling of nano-crystalline silicon TFTs on flexible substrate with mechanical strain"

The gap state density of nano-crystalline silicon active layer on flexible substrate will be redistributed with mechanical bending. The weak or broken bonds may contribute to the redistribution of trap states. During mechanical strain the deep states are redistributed in a Gaussian distribution, and are dissimilar to ordinary acceptor-like deep states which manifest with exponential distributions. We conclude that the DOS with TCAD modeling under mechanical strain is the fundamental reliability issue for the development of flexible electronics. [C177]

#### "A luminescent nano-scale metal-organic framework for sensing small molecules"

A nano-scale metal-organic framework Eu(BDC)<sub>1.5</sub>(H<sub>2</sub>O)<sub>2</sub> was synthesized in a reverse microemulsion system. Scanning electron micrographic (SEM) showed that they were nanorods with 100~200nm in length by 25nm in diameter. Sensing experiments were carried out to examine the potential of Eu(BDC)<sub>1.5</sub>(H<sub>2</sub>O)<sub>2</sub> for sensing small molecules such as acetonitrile and acetone. The luminescent intensity was largely dependent on the solvent molecules in the case of acetonitrile and acetone, which showed no significant change and quenching effects respectively. The result indicated that Eu(BDC)<sub>1.5</sub>(H<sub>2</sub>O)<sub>2</sub> could be developed for the sensing of acetone solvent molecules. Research on the sensing of other small molecules is still underway. [C178]



### "Mesoporous activated carbon from amphiphilic carbonaceous material and its application in EDLC"

Amphiphilic carbonaceous material (ACM), which could be dispersed in alkaline aqueous solutions in nano-scale, was prepared by oxidation of green needle coke. Mesoporous activated carbon was then obtained by further KOH activation, named as AC-A. It was showed that AC-A was a mesoporous material with surface area and pore volume up to 3347 m<sup>2</sup>/g and 1.81 cm<sup>3</sup>/g. For its excellent pore structure and surface characteristics, AC-A was selected as electrode material for Electric double-layer capacitor (EDLC). According to electrochemical tests, AC-A electrode exhibited specific capacitance as high as 348 F/g and also excellent performance under large discharging currents, which was partly attributed to the large specific surface area, high mesoporosity and good surface wettability of the material. [C179]

### "Fully integrated circuit design Aihara's chaotic neuron model"

This paper presents design of the integrated chaotic neuron using 0.8  $\mu$ m single poly CMOS technology, its dynamical behavior analysis. Proposed chaotic neuron consists of several op-amps, sample and hold circuits, a nonlinear function block for chaotic signal generation, a two-phase clock circuits and sigmoid output function block. From HSPICE simulation results of the circuit, approximated empirical equations is induced. Then the dynamical responses of the chaotic neuron such as bifurcation diagram, time series, Lyapunov exponent, and average firing rate are calculated with numerical analysis. [C180]

### "Behaviors of the different dispersers on the morphology of the porous TiO<sub>2</sub> films"

TiO<sub>2</sub>films with nano-particles dispersed by using three different additives such as acetylacetone, Emulsifier OP-10 and polyethylene glycol (PEG) respectively. It is found that the TiO<sub>2</sub>films produced at appropriate amount of Emulsifier OP-10 are no re-aggregation of TiO<sub>2</sub>nano-particles with pores of about 5-15 nm. By adding PEG, the pores of the TiO<sub>2</sub>films could be at about 50 nm to 200 nm. But, by using acetylacetone, aggregations of TiO<sub>2</sub>nano-particles always exist in the TiO<sub>2</sub>films. The related mechanism on the aggregation of nano-particles in the TiO<sub>2</sub>slurries is discussed. [C181]

### "General route of nanowire field effect transistor"

An increasing number of technologies require large-scale integration of separately fabricated nano-objects into spatially organized, functional systems. Here we introduce an approach for dielectrophoresis and reverse transfer printing method. By doing these method we can easily get a nanowire bottom gate transistor with high performance. Firstly, nanowire bridge was formed simply by dielectrophoresis and then by reverse transferring of this bridge on the gate dielectric layer, a nanowire field effect transistor was fabricated. The on/off ratio, threshold voltage, field effect hole mobility, hole concentration and threshold swing of the transistor were measured by  $\sim 6.6 \times 10^6$ , -7.2 V, 9.9 cm<sup>2</sup>/V $\sqrt{s}$  and  $\sim 1.45 \times 10^{16}$ /cm<sup>-3</sup>, and 0.504 V/decade. [C182]

### "Solid freeform fabrication of functionalized ceramic dental crown via selective slurry extrusion process"

Functionalized ceramic dental crown was successfully fabricated through selective slurry extrusion (SSE) of solid freeform fabrication (also known as rapid prototyping) technologies. After being sintered, the decomposed nano-tourmaline powders were embedded in ZrO<sub>2</sub>matrix. The far infrared emission properties of the ceramic dental crown were improved due to the increased number of infrared active bonds coming from the tourmaline. This new dental restoration process presents potential to provide dental patients with functionalized artificial tooth, which benefits body health by means of emitting far infrared rays at ambient temperature. [C183]

### "Electrical properties of Pb(Mg<sup>1/3</sup> Nb<sup>2/3</sup>)O<sub>3</sub>-PbTiO<sub>3</sub> (PMN-PT) epitaxial films grown on Si substrates"

Epitaxially grown PMN-PT thin films using the PMN-PT single crystal targets were prepared at 550°C on appropriate buffer layers of LSCO/CeO<sub>2</sub>/YSZ deposited on a Si substrate using pulsed laser deposition. The micro-structural and the electrical properties of the films were investigated as a function of the film thickness. The PMN-PT films with the thickness from 20 to 600 nm exhibited an epitaxial nature with a pure perovskite structure. On the other hand, the films above 700 nm included a pyrochlore phase embedded in the perovskite structure although they exhibited an epitaxial nature. A pyrochlore phase included in the films above 700 nm thickness decreased the dielectric constant and the ferroelectric properties of the PMN-PT films. [C184]



### "Integrated micro-and nano optical cavities on a chip for supersensitive sensing"

Integrated micro-and nano optical cavities are promising in electro photonic integration devices for their stable performance and compatible potential with optical-fiber technology as well as other electronic photonic integrated circuit. In this paper, we present an optimal design of SOI integrated optical cavities for supersensitive sensing under finite-difference time-domain (FDTD) modeling technique and beam propagation method (BPM). Phase match and coupling distance between the straight waveguide and the cavity are discussed. After showing the optical cavities fabricated with SOI, testing experiment was carried out, obtaining the transmitted spectrum in the near-infrared telecommunication bands. Analyzing transmission peaks using FWHM method, Q about 1000 is estimated. In the last part of this paper, the potential and promising prospective for supersensitive sensing is demonstrated. [C185]

### "Top emerging technologies for self-powered nanosystems: nanogenerators and nanopiezotronics"

Developing wireless nanodevices and nanosystems are of critical importance for sensing, medical science, defense technology and even personal electronics. Power sources are indispensable for independent, sustainable, maintain-free and continuous operations of implantable biosensors, ultrasensitive chemical and biomolecular sensors, nanorobotics, micro-electromechanical systems, remote and mobile environmental sensors, homeland security and even portable/wearable personal electronics. It is highly desired for wireless devices and even required for implanted biomedical devices to be self-powered without using battery. This is a key step towards self-powered nanosystems. The near future research is the integration of multi-functional nanodevices into a nanosystem so that it can function as a living species with capabilities of sensing, controlling, communicating and actuating/responding. A nanosystem is composed of not only nanodevices but also nano-power-source (or nano-battery). We now consider the following occasions. In cases where individual sensors are difficult to get to (e.g., in hostile territory), or if the sensor network consists of a large number of nodes distributed over a large geographic area, then it may not be possible to replace batteries when required. A self sufficient power source deriving its power from the environment and thus not requiring any maintenance would be very desirable. In order for any system to be self sufficient, it must harness its energy from its surrounding environment and store this harnessed energy for later use. The goal for nanotechnology is to build self-powered nanosystems that exhibit ultrasmall size, supersensitivity, extraordinary multi-functionality and extremely low power consumption. [C186]

### "Technological bricks and concepts for THz remote sensing"

We present technological bricks and concepts under study which could permit build up of future THz remote sensing systems. Critical issues regarding such systems mainly rely on the availability of sensitive and compact detectors together with powerful and versatile sources. Potential use of plasma waves in nano-transistor is presented which can be exploited for the realization of an efficient mixer operating at THz frequencies to be implemented in a coherent detection scheme. In such a scheme the necessary local oscillator is obtained from a solid state dual frequency laser whose architecture is also detailed. On the emitter side, the preliminary realization of sub-millimeter wave to THz amplifier based on vacuum tube technology, including carbon nano-tubes is also presented. [C187]

### "Nucleation and growth of epitaxial silicide in nanowire of silicon"

When two nanowires cross each other, they form a point contact. Point contact reaction between a nano metal wire and a nano Si wire has been studied by using ultra-high vacuum and high resolution transmission electron microscopy. Axial epitaxial growth of nano silicides of NiSi and CoSi<sub>2</sub> in nanowires of Si has been observed. The nucleation stage and stepwise growth stage of the reactive epitaxial growth of nano silicide on nano Si have been measured. A repeating event of homogeneous nucleation has been found, which enables us to estimate the number of molecules in a critical nucleus to be about 10 using the Zeldovich factor. A comparison to heterogeneous nucleation will be made. The nucleation-controlled or supply-controlled growth mode of point contact reactions is different from the well-known diffusion-controlled and interfacial-reaction-controlled modes of growth in thin film and bulk samples. [C188]

### "Theoretical analyzing of monomers adsorbing in nano-slits"

A revised model based on Lattice-Density-Function Theory (LDFT) was built in this paper and was used to indicate the adsorbing behaviors of monomers in nano slits. This work tried to establish a theoretical model and get the fundamental mechanisms of the in situ-monomer-intercalation process which is the most common production method of polymer-layer silicate intercalated nanocomposite (PLSN). According to the results, the multilevel adsorption and 3D phase transition phenomenon in nano slits predicted by original LDFT do not exist in reality. They are probably aroused by system errors caused by simple mean field approximation treatments. The



nano slits have obvious boundary effects on density profile distribution of monomers. [C189]

#### "A model for THz silicon nanotube transistor"

In this work, a schematic model of single-walled silicon nanotube (SWSiNT) devices is presented aimed at advancing the understanding of nano-electronic field. The circuit model of one-dimensional SWSiNT devices is firstly proposed. The cutoff frequency of SWSiNT devices is obtained, opening up the possibility of a THz silicon nanotube transistor. [C190]

#### "Improvement of thermal stability of Cu/Cu(Zr)/p-SiOC:H film stack using an ultra-thin Zr(Ge) alloy film as an exhaustion interlayer"

Nano-layered films of Cu/Cu(Zr)/Zr(Ge) and Cu/Cu(Zr) were deposited on the Si/SiOC:H substrates by magnetron sputtering. Samples were subsequently annealed at temperatures ranging from 350~500°C in vacuum, and characterized by four-point probe technique, glancing incident angle X-ray diffraction, Auger electron spectroscopy (AES) and transmission electron microscopy. The results indicated that the thermal stability of Cu/Cu(Zr)/Zr(Ge)/SiOC:H/Si structure was fairly good when an ultra-thin Zr(Ge) layer used as an interlayer material. Upon annealing at 450°C, a self-grown ZrOx/Cu<sub>x</sub>Ge layer formed at the interface between Cu(Zr) and SiOC:H. This self-grown layer strongly prevented Cu diffusion into SiOC:H and free Si atoms into Cu film. In contrast, the diffusion of Cu atoms into SiOC:H was apparent for Cu/Cu(Zr)/SiOC:H/Si structures at this temperature, even if the Zr content in the Cu(Zr) film is up to 25.6 at.%. In addition, the impacts of Zr(Ge) contents on the thermal stability of film stacks and the resistivity of the multilayered structure are also discussed. [C191]

#### "Fabrication and structure characterization of Te butterfly nanostructures"

Te butterfly nanostructures and nanowires have been fabricated by template-free electrodeposition (TFED) in aqueous solution. By high-resolution transmission electron microscopy (HRTEM) study, the favored growth direction of the wings of the butterfly nanostructures and nanowires was determined to be along the [0001] direction of trigonal Te, and the twinning plane of the butterfly nanostructures was (11-22). The cathodoluminescence measurements carried out at different positions of the butterfly nanostructure indicated that the twin boundary influenced the photoemission efficiency. [C192]

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#### "Teaching non-linear dynamics through educational kits: Demo of memristor circuit kit"

Summary form only given. Education has been rated by Nobel laureate Prof. R. E. Smalley as one of the top ten challenges to be faced by humanity in the next 50 years. Many attempts have been made by several researchers and policy makers to address the issue of effective education. T. Grotzer from Harvard Graduate School of Education (HGSE) emphasized that the teachers, along with teaching scientific skills, encourage students to locate opportunities and apply those skills at appropriate situations. Similarly, Nobel laureate Prof. Carl Wieman proposed the use of scientific approach to science learning. He has argued in that understanding of the concepts as well as retention by students is much more effective if a student is involved with the class rather than being a passive listener. He also recommended the use of educational circuit kits to have a better impact on the students. After the recent discovery of memristor, many researchers including Prof. Leon Chua and Dr. Stan Williams recommended the need of introducing memristor to high school students. A similar argument was made in, where the authors recommended introducing chaos theory to high school students. The present demo aims to introduce the researchers and teachers with plug and play circuit kit of memristor. The memristor kit can greatly help students of nano-technology involved in understanding this recently discovered device. In fact, Valparaiso community schools recently started a program to introduce nano technology, including memristor, to talented elementary school children. The present memristor kit can be highly beneficial to such initiatives. At 2nd Memristor and Memristive Systems Symposium (CNNA 2010), the present demo would attempts to attract the attention of both high school science teachers to understand the use of such kits for their students as well as researcher active in the field of memristor based designs. [C195]



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## "Influence of nano-embossing on properties of Pb(Zr<sub>0.3</sub>,Ti<sub>0.7</sub>)O<sub>3</sub> ferroelectric thin film"

In this work, we apply nano-embossing technology to fabricate Pb(Zr<sub>0.3</sub>, Ti<sub>0.7</sub>)O<sub>3</sub> (PZT) ferroelectric thin film nanostructures and investigate the influence of the patterning process on the material and ferroelectric properties by using SEM, XRD and Precision Ferroelectric Tester. Embossing process has been optimized for embossing depth and pattern profile. It was found that embossing will result in (100) preferred orientation of the PZT thin film. The electrical characteristics of patterned and unpatterned PZT films have been also studied for comparison. [C201]

## "Carbon-assisted growth technology for ZnO nanowires"

Using thermal evaporation of ZnO at high temperature in vacuum, we fabricated ZnO nanowires (NWs) directly on carbon-based materials (amorphous carbon and photoresist). SEM observations showed that ZnO NWs preferentially nucleate on carbon and grew perpendicularly to the surface of the carbon-based materials. Based on this new developed carbon-assisted growth technology, we realized large-area and patterned growth of high-quality ZnO NWs with low cost. [C202]

## "The study of mechanical characteristic of electrodeposited nanocrystalline Ni-Co alloy"

The electrodeposited nanocrystalline by nano-plating technology is used in electronic components and have more excellent properties in tribological property and service life. In this paper the electrodeposited nanocrystalline of Ni-Co alloy nano-plating technology is introduced and the influence of pulse frequency on micro-hardness, internal stress and micro-morphology of high frequency pulse electroplating Ni-Co composite coating is studied. The results show that as the frequency increased, the surface of the plating tended to be more compact and internal stress of the plating is lower. As surfactant, sodium allylsulfonate, saccharin sodium and thiourea improve the micro-hardness evidently and thiourea is the best one of them, reached 526 HV. [C203]

## "Preparation of mesoporous N-doped TiO<sub>2</sub> via solvent evaporation induced assembly"

Mesoporous, nitrogen-doped TiO<sub>2</sub>(TiO<sub>2</sub>-xNx) nano-crystal is potentially technologically important materials due to its developed porosity and visible-light responsive performance. These are important parameters for photocatalysis and dye sensitized solar cells (DSSCs) with regard to adsorption and conversion of solar energy efficiency. We have recently developed an effective solvent evaporation induced assembly (SEISA) procedure for the preparation of mesoporous TiO<sub>2</sub>-xNxT nano-anatases. The wormlike mesoporous nanocrystal TiO<sub>2</sub>-xNx has been prepared using SEISA method and compared with that synthesized via sol-gel methods. The SEISA method has many advantages over widely-used sol-gel method with regard to porosity and surface area. Also, the SEISA method is less water sensitive than traditional methods which makes it more effective for the fabrications of photocatalysts and DSSC devices. [C204]

## "In situ Atomic Force Microscope observation of self-assembly adsorption of Bovine Serum Albumin on silica and gold nano film"

The self-assembly adsorption of bovine serum albumin (BSA) on the hybrid surface including the discontinuous



gold nano film and silica under liquid condition was studied in situ by atomic force microscope (AFM) at room temperature. To investigate the adsorption of BSA on silica and gold nano film simultaneously, the surface with discontinuous gold nano film and visible blank block on silica by physical vapor deposition (PVD) and the ultrasonic cleaning technology was fabricated. Then we observed the variation on the substrate surface before and after injecting BSA aqueous solution with a 0.05 mg/ml concentration at real time by AFM. The experimental results indicated that the adsorption strength of BSA on the surface of gold nano film is larger than that on silica surface, and further implied that the adsorption capability of the hydrophobic surface is larger than that of the hydrophilic, which is consistent with those reported. Moreover, it could be easily observed that the adsorption of BSA on gold nano film has great tendency to form a ridgeway-like topography. [C205]

#### "Hybridization of ODNs with core-shell structure of Fe<sub>3</sub>O<sub>4</sub> nanoparticles and CSALG composite structure"

This study attempts to develop super-paramagnetic nanocomposite structure which have both magnetic and biocompatibility. With magnetic composite structure, nano-composite structure could be applied to bio-labeling, a specific tissue target detection and drug treatment. The author prepares Fe<sub>3</sub>O<sub>4</sub> nanoparticles by chemical deposition. The diameter of the particle is about 20 nm, and is coated by CSALG complex membrane. Finally, the prepared nanocomposite structure undergone conjugating reaction with different types of ODNs are mixed in culture cell, so that they are linked together through the hybridization between different types of ODNs. [C206]

#### "Molecular dynamics simulation of Argon-atom bombardment on graphene sheets"

By a molecular dynamics method and using different incident energy and particle density, we calculated the argon-atom bombardment on a graphene sheet. The results show that, the damage of the bombardment on the graphene sheet depends not only on the incident energy but also on the particle density of argon atoms. To compare and analyze the effect of the incident energy and the particle density in the argon-atom bombardment, we defined the impact factor on graphene sheet of the incident energy and the particle density by analyzing the structural Lindeman-index and calculating the broken-hole area of the sheet, respectively. The results indicate that, there is a critical incident energy and particle density for destroying the graphene sheet, and there is an exponential accumulated-damage for the impact of both the incident energy and the particle density in argon-atom bombardment on a graphene sheet. Our results supply some valuable mechanics parameters for fabrication of potential graphene-based electronic devices with high particle radiation. [C207]

#### "Controlling environmental pollution by application of inartificial nano material"

Nano technology and nano material were widely applied to solve the problem of water pollution. It is known that on their way forward, people are bound to run into lake's eutrophication in the world, owing to pollution source not being controlled. Among all pollution sources, agricultural widespread pollution, such as fertilizer's nutrient to wash away, and inner pollution in the lake, such total nitrogen and phosphorus, COD and algae, have yet not to find effective controlling their methods. Recent advances in research on application of nano material have opened new areas of study in the field of the lake's eutrophication prevent and treatment, using magnetic or non-magnetic nano materials. Nano materials which were pretreated by modification of chemistry treatments could self-assemble a micro-nano network in aqueous phase. Pollutant micro molecules were banded around the micro-nano network by hydrogen bond, Van Der Waals force and viscous force, to enlarge their spacial scale comparing with that of water molecule, so that they could easily be separated from water. Fertilizer-loss-control technology has been invented by micro-nano network structure of the nutrient which is blocked by soil filtration. The magnetic separation of water-algae technology was invented by adding magnetic material into micro-nano network materials. Both of these technologies are being engineered and industrialized. The output of controlled releasing fertilizer-loss-control agent reached 2 GtB— 104 tonnes per year, magnetic flocculating agent was 5000 tonnes per year. [C208]

#### "Spatio-temporal segmentation of the heart in 4D MRI images using graph cuts with motion cues"

With the increasing availability of 4D cardiac imaging technologies, the need for efficient spatio-temporal segmentation algorithms for the heart is growing. We propose a new method for heart segmentation in 4D data sets. We efficiently use the established graph cut method for the segmentation of the heart by simultaneously exploiting motion and region cues. We construct a 4D graph designed to find a moving object with a uniform intensity from a static background. This method has useful applications ranging from qualitative tasks such as direct visualization of the heart by removing its surrounding structures, to quantitative tasks such as measurements and analysis of the total heart volume. The method has been tested on cardiac MRI sequences with successful results. [C209]



### "Intravascular ultrasound: Assessment of atherosclerosis"

Intravascular ultrasound (IVUS) is a technology that uses an ultrasound element on the tip of a catheter. This catheter is advanced through the groin into the coronary arteries. In this way a tomographic image of the vascular wall and atherosclerotic plaques can be produced. Historically it has been used to assess the level of occlusion, the atherosclerotic plaque burden and the native size of the vessel. This information can be used to decide to treat or not and to determine the diameter and length of the stent to be used for treatment. It has also been used extensively to determine if the stent was well deployed. The composition and morphology of an atherosclerotic lesion are currently considered more important determinants of acute coronary ischemic syndromes than the degree of stenosis. When a lesion is unstable, it can rupture and cause an acute thrombotic reaction. An unstable plaque can be characterized by a lipid core that is covered by a thin fibrous cap, which has been locally weakened by inflammatory cells. The last decade serious effort has been put in developing IVUS towards identifying these unstable plaques. This lecture will focus on the development of measuring the elastic properties of the plaque as a marker for plaque instability and measuring the vascularization in the plaque, which plays an important role in the pathogenesis of unstable plaque. Furthermore the role of combined ultrasound/light catheters will be discussed. Technology development and validation will be presented as well as the role of IVUS to provide imaging biomarkers in natural history studies and trials for the development of new cardiovascular drugs. [C210]

### "Chemical profiling of the plant cellwall through Raman microspectroscopy"

This paper presents a computational framework for chemical profiling of the plant cell wall through the Raman spectroscopy. The system enables query of known spectral signatures and clustering of spectral data based on intrinsic properties. As a result, presence and relative concentration of specific chemical bonds can be quantified. The primary contribution of this paper is in representation of Raman profile in terms of fluorescence background and multiscale peak detection at each grid point (voxel). Such a representation allows efficient spatial segmentation based on the coupling between high-level salient properties and low-level symbolic representation at each voxel. The high-level salient properties refer to preferred peaks and their attributes for the entire image. The low-level symbolic representations are based on fluorescence background, spectral peak locations, and their attributes. We present results on a corn stover tissue section that is imaged through Raman microscopy, and the results are consistent with the literature. In addition, automatic clustering indicates several distinct layers of the cell walls with different spectral signatures. [C211]

### "Piecewise linear cylinder models for 3-dimensional axon segmentation in Brainbow imagery"

Generalized cylinder shapes are ubiquitous in biological systems and image processing techniques to identify these tubular objects in 3D from biomedical imagery in various modalities is a general problem of interest. One such structure that exhibits branching tubular forms are neuronal networks; specifically, recent developments in microscopy imaging technology allow researchers to acquire massive amounts of 3D color images of neural structures that need to be tracked in 3D to extract structure for the purpose of studying function. In this paper, we propose a piecewise linear generalized cylinder tracing algorithm that exploits both edge and color information in order to automatically trace axons of neurons in Brainbow imagery. Results indicate that the proposed method can successfully trace multiple axons in dense neighborhoods. [C212]

### "Appearance analysis for diagnosing malignant lung nodules"

An alternative method of diagnosing malignant lung nodules by their visual appearance rather than conventional growth rate is proposed. Spatial distribution of image intensities (or Hounsfield values) comprising the malignant nodule appearance is accurately modeled with a rotation invariant second-order Markov-Gibbs random field. Its neighborhood system and potentials are analytically learned from a training set of nodule images with normalized intensity ranges. Preliminary experiments on 109 lung nodules (51 malignant and 58 benign ones) resulted in the 96.3% correct classification (for the 95% confidence interval), showing the proposed method is a promising supplement to current technologies for early diagnostics of lung cancer. [C213]

### "Electro-thermal modeling of nano-scale devices"

In this paper we present simulation results obtained with our electro-thermal device simulator when modeling different technology generations of nano-scale fully depleted Silicon-on-Insulator (FD-SOI) devices. The electro-thermal simulator is based on a combined ensemble Monte Carlo device simulator coupled to moment expansion of the phonon Boltzmann transport equations. In particular, we stress out the importance of the temperature boundary conditions for digital and analog circuits and the use of the full model which takes into account both temperature and thickness dependence (which is particularly important for thin silicon films) of the thermal



conductivity. [C214]

### "Computer aided detection in breast imaging: More than perception aid"

In breast cancer imaging many innovations continue to take place. This paper discusses computer aided detection (CAD) of breast cancer in mammograms, which is the first large scale application of independent computerized interpretation of radiological images. Thousands of systems have already been installed worldwide and use of CAD is rapidly expanding with the introduction of digital mammography. Despite this success, most radiologists believe that the performance of CAD should be improved to make it more useful. CAD algorithms do not yet operate at the level of performance of trained human readers, while there is no reason to doubt that this is an achievable goal. The most common complaint of radiologists using mammography CAD is that current algorithms have too many false positives. Indeed, considering that current CAD algorithms operate at a level of one or two false positives per four view case (MLO and CC views of the right and left breast), there are still a few hundred false positives for every true positive in a screening setting. When asked what is so bothering about false positives, some comment that they confuse them or slow down the reading. However, the worst aspect of false positives is that readers lose confidence in CAD, as they see many irrelevant CAD marks on obviously normal regions. They wonder how a system that operates so poorly in some aspects can ever help them. Interestingly, experienced readers seem to have more faith in CAD than inexperienced readers. Perhaps experienced radiologists are more tolerant to false positives because they can easily dismiss them. They also recognize the main value of current CAD systems: the very high sensitivity. When reading fast, perceptual oversights occasionally occur, and CAD may help to avoid those. Of course, this is particularly important when there is no double reading. For less experienced radiologists dismissing false positives is less easy, and they may have to spend a significant amount of time to interpret CAD marked regions. The fact that CAD may confuse readers is an important message to CAD researchers. It reveals the rather obvious, but often neglected truth that radiologists have difficulty in interpreting mammographic regions and making the right decisions. In screening programs the decision to be made is if a woman should be recalled or not. Ideally, there should be a clear line between suspicious mammographic regions that require additional workup and other mammographic findings. Screening would then simply be the task of finding these regions, and misses could be classified as 'search errors'. This simple model of breast cancer screening is often advocated by 'expert' screening radiologists and forms the basis of current CAD technology. CAD users are instructed to use the technology as a 'checker' to avoid oversights, but are discouraged to use it as an interpretation aid. Despite these clear guidelines, it is highly likely that many radiologists do use CAD as an interpretation aid when they become more familiar with the technique. They realize that the high negative predictive value of CAD is very valuable. Suppose a reader doubts whether to make a recall or not given the presence of an uncertain mammographic finding. When using CAD, the reader will know that the likelihood that a cancer is present becomes lower when CAD does not mark the region and higher when CAD does mark it, in particular if it is marked in multiple views. Using this information makes a lot of sense and will lead to better decisions on average. To this end, CAD information should be weighed properly, which is something the reader should learn from experience. This potential of CAD has been convincingly demonstrated in a study where CAD was combined independently with reader scores. To further explore the idea of using CAD as an interpretation aid an experimental environment was developed in which CAD information is presented interactively to the readers. First res [C215]

### "Twin target correction for ultra-wideband radar imaging of breast tumours"

Ultra-wideband radar imaging is a promising modality of imaging for breast cancer detection, based on the dielectric contrast between healthy and pathological tissues. Its aim is to create a map of microwave scattering, and has already proven encouraging results. Unfortunately, the tumor extraction procedure used for reconstruction of the scattering volume leads to the appearance of an artifact called twin target, where a single tumor is expected. In this paper, a signal processing technique is presented to remove this twin target and enhance the contrast of the final image. The radar system and image formation algorithm are first described to explain the origin of the twin target. Experimental data are then acquired and processed by our correction algorithm, demonstrating its ability to fix the twin target issue. [C216]

### "Challenges in MR image acquisition and analysis for probing the human connectome in vivo"

One of the basic principles underlying modern neuroscience is that of connectional specificity; that is, neurons in different regions of the brain do not form connections randomly but rather in a manner that facilitates the processing of information among regions with related functions. A full characterization of the connectional specificity of the human brain would require identifying all connections between individual neurons and mapping the trajectories of the axons that connect them. This neuronal connectivity diagram, referred to as the human connectome, is unknown and beyond the reach of current technologies. However, recent advances in diffusion and functional MRI have opened the way to the study of major pathways in the brain, which are formed by



bundles of axons running in parallel and terminating in groups of neurons with architectonic and functional homogeneity. These advances have brought us excitingly close to the in vivo, noninvasive mapping of the human connectome at the aggregate level but several technical challenges remain to be addressed. [C217]

#### "Low rank matrix recovery for real-time cardiac MRI"

Real-time cardiac MRI is a very challenging problem because of limitations on imaging speed and resolution. To address this problem, the  $(k,t)$ -space MR signal is modeled as being partially separable along the spatial and temporal dimensions, which results in a rank-deficient data matrix. Image reconstruction is then formulated as a low-rank matrix recovery problem, which is solved using emerging low-rank matrix recovery techniques. In this paper, the Power Factorization algorithm is applied to efficiently recover the cardiac data matrix. Promising results are presented to demonstrate the performance of this novel approach. [C218]

#### "Investigation on the effective immunity to process induced line-edge roughness in silicon nanowire MOSFETs"

The silicon nanowire MOSFET (SNWT) with gate-all-around (GAA) architecture has exhibited great potential in high-performance nano-electronics applications. However, line-edge roughness (LER) induced by lithography and etching processes has become a critical concern for decananometer MOSFETs, because it does not scale accordingly with line widths. Especially, the LER of nanowires, which contains two degrees of freedom rather than one in the traditional planar devices, may have different and intriguing effect on SNWTs. Therefore, performance variation of SNWTs induced by nanowire-LER may become a great challenge to scalability and stability of SNWT-based ICs, where 2-D geometrical fluctuation becomes an even more serious problem in nano-scale. Yet, only few preliminary studies on such impact have been reported. In this paper, a full 3-D statistical investigation is performed, based on the measured LER from SEM images, to estimate the impact of nanowire-LER on SNWTs, including both DC and analog/RF performance. The results can provide guidelines for process optimization as well as robust design of SNWT-based circuits. [C219]

#### "A 30 nm gate-all-around poly-Si nano wire thin-film transistor"

In this work, gate-all-around (GAA) poly-Si nano wire (NW) thin film transistors (TFTs) with record physical gate length of 30 nm and driving current  $>100 \mu\text{A}/\mu\text{m}$  are demonstrated. The cross section of the NW channel is as small as 35 nm  $\times$  8 nm. The tight GAA and NW structure enhances the gate potential control ability effectively, therefore, excellent short channel and narrow width behaviors can be obtained. These results reveal the possibility of three-dimensional integrated circuits. [C220]

#### "Registration-based propagation for whole heart segmentation from compounded 3D echocardiography"

Whole heart segmentation of 3D ultrasound (US), also referred to as echocardiography or simply echo, is useful in cardiac functional analysis to achieve quantitative diagnostic information of the heart. However, characteristics of US imaging such as limited field-of-view, artifacts and inconsistent intensity distribution makes automated approaches a challenge. In this paper, we present a framework for automatic whole heart segmentation from 3D echo. This work is motivated by the new technology of compounding 3D echo from 2D matrix array transducers. We propose to use the registration-based segmentation framework and adopt a new similarity measure combining local phase, intensity information and local geometry for registration. The experimental results demonstrated the proposed method had achieved an accuracy of 6.4% volume difference against the gold standard for the left ventricle segmentation and an average accuracy of 14% for segmentation of all four chambers and myocardium. [C221]

#### "Sufficient condition for local invertibility of spatio-temporal 4D B-spline deformations"

Recent advances in medical imaging technologies have made 4D image sequences available in clinical routine. As a consequence, image registration techniques are evolving from alignment of pairs of static volumetric images to spatio-temporal registration of dynamic (4D) images. Since the elastic image registration problem is ill-posed, additional prior information or constraints are usually required to regularize the problem. This work proposes to enforce local invertibility (diffeomorphism) of 4D deformations. A novel sufficient condition for local invertibility over continuous space and time is proposed and a practical regularization prior is designed from the theory. The method has been applied to an image registration (motion tracking) of a dynamic 4D CT image sequence. Results show that using proposed regularizer leads to deformations that are more plausible for respiratory motion than the standard approach without additional temporal regularization. [C222]



### **"Advancing the technology and applications of surgical fluorescence imaging with targeted fluorochromes"**

A new concept aiming to improve surgical outcome by providing real-time surgical feedback on tumor margin delineation is presented. We are using a novel multispectral imaging system for real time measurement of fluorescence probes with molecular specificity to tumor biomarkers. Mice bearing xenograft tumors were used to simulate surgical operations of tumor excision guided by real time fluorescence imaging. Bioluminescence imaging and histopathology were used as gold standards to confirm the in-vivo findings. Results demonstrate the capability of the method to identify tumor negative margins with high specificity and provide real time feedback to the surgeon. [C223]

### **"Whole body imaging with dynamic volume 320-row CT"**

State of the art of CT technology will be presented. It has a z-coverage of 16cm to cover most of the organs in one single, non-helical, rotation. Whole body imaging using different scan methods will be presented, and a comparison in terms of scan time with helical scan mode will be discussed. [C224]

### **"12-Channel 4 20-Gbps on-board parallel optical modules using multi-chip visual alignment technique"**

We have developed 12-channel 4 20-Gbps optical transmitter/receiver modules with 9 4 14-mm footprints. To achieve stable optical coupling efficiency, we also developed a precise multi-chip mounting technique. The three dies of 4-channel vertical-cavity surface-emitting laser (VCSEL)/photodiode (PD) arrays are mounted at the same time. The accuracy of the Z-axis can be controlled by monitoring the dies' positions for the optical reference plane. The coupling losses were less than 1.5 dB in the 12-channel transmitter/receiver modules. The standard deviations of the coupling losses were less than 1.0 dB in all samples. Error-free transmissions at a data rate of 20 Gbps were also demonstrated. A reliability test indicated that the modules are repairable and reliable. [C225]

### **"A study of package warpage for package on package (PoP)"**

Package warpage is a primary concern in a package-on-package. To enhance the accuracy of modeling prediction, viscoelastic parameters, the change of material properties after injection mold cure (IMC) and post mold cure (PMC) temperature and its time, and cure shrinkage were studied with a dynamic modulus analysis (DMA) and a thermal mechanical analysis (TMA) for a mold compound. A nano-indentation tool was used to characterize a viscoelasticity of underfill material. Material properties obtained from the TMA, DMA and nano-indentation tools were introduced to finite-element-based models. The validation of models was verified with a shadow moiré for package warpage. [C226]

### **"High power and fine pitch assembly using solder Anisotropic Conductive Films (ACFs) combined with ultrasonic bonding technique"**

In this study, in order to improve the electrical properties and the reliability of ACF joints, we propose the simultaneous fluxless solder joining and adhesive bonding technology. This technology utilizes fluxless soldering within an adhesive matrix on metal electrodes combined with room temperature ultrasonic (U/S) ACF bonding technique advantages. According to the experimental results, the temperature of the solder ACF joints showed rapid heating rates up to 400 °C/s and peak values above 250°C by applying ultrasonic vibration. The ACF temperature could be precisely controlled ranging from 75°C to 260°C by adjusting U/S vibration amplitudes from 4 µm to 13 µm. At above the melting temperatures of solder particles, U/S bonded solder ACF joints showed higher than 80% soldering ratios and no void formation with optimized U/S parameters. The soldering ratio at the solder ACF joints increased as the ACF temperature increased and it was presumably due to the viscosity decrease of the ACF adhesive matrix. On the other hand, thermocompression (T/C) bonded solder ACF joints showed poor soldering ratios lower than 30% and severe void formation at above 200°C. At the same time, U/S bonded solder ACF joints showed 30% reduced electrical contact resistances and twice better reliability in an unbiased autoclave test (121°C, 2 atm, 100%RH) compared with conventional ACF joints. Significance of this result is that fluxless solder joining and adhesive bonding can be simultaneously achieved within 5 seconds by using solder ACFs combined with the room temperature U/S bonding technique. [C227]

### **"Room-temperature Si-SiN wafer bonding by nano-adhesion layer method"**

Nano-Adhesion layer bonding method is proposed for heterogeneous wafer bonding at room temperature. The wafer surface is smooth, clean, and activated by nano-adhesion layer method which sputter cleaning and deposition Fe simultaneously. Si-Si and Si-SiN wafers were directly bonded at room temperature and the



bonding strength was increased by optimizing Fe composition ratio on the Si surfaces. We analyzed atomic structure and bonding states at bonding interface by using cross-sectional HRTEM, STEM and EELS and discussed nano-adhesion layer formation, bonding interface structure, and bonding mechanisms. Our results show that bonding interfaces are composed of Si/FeSi/Si and Si/FeSi/FeSiN/SiN of Si-Si and Si-SiN, respectively. [C228]

### "Nano-World: A showcase suite for technology-enhanced learning"

Over the past couple of years we have defined and implemented a variety of tools and instruments for supporting technology-enhanced teaching within the field of Nanoscience. Among others, the Nano-World showcase suite developed includes the following: a collaborative simulator for learning the basics of atomic force field microscopes; a remote laboratory which offers real-world access to experiments at the nanoscale level; software infrastructure for remote control and steering of ongoing experiments using mobile devices; interactive courseware that teaches the basic laws of physics such as force fields; a web-based platform for 3D visualizations of data collected via nano microscopes; and an interactive game for getting first impressions of atomic manipulations. In the paper we describe the different components and report on lessons learned from using the showcase within the university curriculum as well as an information medium for schools and public audiences. We also report on plans and first steps to interface the showcase suite with LiLa-the forthcoming library of labs. [C229]

### "MEMS packaging technologies & applications"

MEMS packaging has become a major manufacturing issue for commercialization. This talk will give a short summary on several MEMS packaging technologies, including an integrated LPCVD nitride bonding process; localized eutectic, fusion and solder bonding processes; RTP (rapid thermal processing) bonding processes; nano-second laser welding process; ultrasonic sealing process; and localized CVD sealing process. The key development in low-temperature solder bonding process will be the focus of the paper by using metals as the MEMS packaging materials to overcome limitations of glass frit bonding. Two bonding methods including the pre-reflow of solder the introduction of thin metal layer are presented. [C230]

### "Computation reduction for statistical analysis of the effect of nano-CMOS variability on asynchronous circuits"

The intrinsic atomistic variability of nano-scale integrated circuit (IC) technology must be taken into account when analyzing circuit designs to predict likely yield. Monte Carlo (MC) based statistical techniques aim to do this by analysing many randomized copies of the circuit. A major problem is the computational cost of carrying out sufficient analyses to produce statistically reliable results. The MC analyses required for asynchronous circuits are more difficult than are generally required for clocked circuits because of the more complex timing patterns created by handshaking mechanisms. It is important to reduce the computational complexity of MC analysis required for asynchronous circuits. The use of 'Statistical Behavioural Circuit Blocks (SBCB)' is investigated as a means of reducing the dimensionality of the analysis, and this is combined with an implementation of 'Statistical Blockade' to achieve significant reduction in the computational costs. The reduction in computation time achieved by the more efficient MC analysis is illustrated by statistically analysing several simple handshaking circuits. [C231]

### "Instruction reliability analysis for embedded processors"

Advances in silicon technology and shrinking the feature size to nanometer scale make unreliability of nano devices the most important concern of fault-tolerant designs. Soft error analysis has been greatly aided by the concept of architectural vulnerability factor (AVF) and architecturally correct execution (ACE). In this work, we exploit the techniques of AVF analysis to introduce the instruction-level vulnerability metric for software reliability analysis. The proposed metric can be used to make judgments about the reliability of different programs on different processors with regard to architectural and compiler guidelines for improving the processor reliability. [C232]

### "Nano-integrated adhesive for cryogenic packaging (4K) of harsh environment electronics"

In the current research we have developed a thermally enhanced and electrically non-conductive nano-integrated adhesive for ultra-low temperature (4K) cryogenic microelectronic packaging. Ultra-low temperature niobium based (4K) superconductor microelectronics offer the unique combination of ultrafast switching speeds (up to 100GHz), high sensitivity and low power consumption. The commercialization of these cryogenic microelectronic devices in a complex multichip module architecture where the integration of heterogeneous material and increased power density is generating a need to develop new materials and techniques to enhance the thermal



and electrical performance of these ultra-low temperature superconducting microelectronic packages. In the current research, authors have investigated the thermal behavior of single-walled carbon nanotube integrated adhesive for the packaging of ultra-low-temperature (4K) electronics. Test vehicles loaded with varying concentrations of purified single-walled carbon nanotube (SWNT) integrated adhesive were characterized at 4K. The nano-integrated adhesive showed increasingly higher thermal conductivity than the pure adhesive with higher loading concentration. The thermal analysis of the nano-integrated adhesive suggests that single-walled carbon nanotube filled adhesive can play a profound role as an underfill and die attach in cryo-packaging for ultra-low temperature high density multi-chip modules (MCM). [C233]

#### **"High speed touch screen panels (TSPs) assembly using anisotropic conductive adhesives (ACAs) vertical ultrasonic bonding method"**

In this study, the effects of vertical ultrasonic (VUS) bonding parameters such as vibration amplitudes and bonding pressures were investigated and optimized in terms of thermal deformation of TSP polymer substrates, electrical continuity, and pull adhesion strength of anisotropic conductive adhesive (ACA) joints. And the reliability of VUS bonded TSP ACA joints were evaluated at various test conditions. As the vertical ultrasonic vibration was applied, ACA temperatures rapidly increased due to the spontaneous heat generation in the ACA itself and surrounding polymers. The ultrasonic vibration showed significant effects on the peak temperature of the ACA layers, and the bonding pressure affected the heating rates. By adjusting both ultrasonic vibration and bonding pressure, the ACA temperature could be successfully controlled. In terms of thermal deformation, VUS bonding showed no severe thermal deformation of TSPs up to 120°C which is much higher than the T<sub>g</sub> of polyethylene terephthalates (PETs) which are the base material of TSPs. In terms of electrical continuity of the ACA joints, VUS bonded TSPs showed stable electrical resistances at 2 MPa bonding pressures, and there were no significant effects of vibration amplitudes and bonding times on contact resistances. At the same time, VUS bonded TSPs showed strong adhesion at the ACA joints with 1 second bonding time at 7.5 μm vibration amplitude and 2 MPa bonding pressure. During the FPCB pull test, VUS bonded TSPs showed higher than 3 kgf pull strengths. Therefore, VUS bonding parameters were optimized at 7.5 μm vibration amplitude, 2 MPa bonding pressure, and 1 second bonding time in terms of PET thermal deformation, electrical continuity and pull adhesion strength of the TSP ACA joints. With the optimized parameters, various reliability tests were conducted such as thermal shock test, salt spray test, high temperature/high humidity test, high temperature storage test and writing test. After each test, the--VUS bonded TSPs showed no significant changes in electrical resistance compared with those of thermo-compression bonding. As a summary, the VUS method can be successfully used in TSPs assembly with no thermal damages, higher speed assembly and good reliability. [C234]

#### **"Effect of Ni-coated carbon nanotubes on the microstructure and properties of a Sn-Ag-Cu solder"**

In this work, varying weight percentages of Ni-coated CNTs (Ni-CNTs) were incorporated into the Sn-Ag-Cu matrix to develop composite solders. The samples were extruded and characterized in terms of their thermal, wettability, microstructural, tensile and nano-mechanical properties. Our characterization results established that the composite technology coupled with nanotechnology in electronic solders can lead to 8% improvement in mechanical performance (in terms of 0.2% yield strength), 12% increase in the ultimate tensile strength and better creep behavior. With the addition of Ni-CNTs, there is no compromise on the melting point of the solder alloy and in fact a better wettability of the nanocomposite solders was observed. Thus, such a Ni-coated CNT filler in Sn-Ag-Cu solder provides a promising interconnect materials for microelectronics assembly and packaging industry. [C235]

#### **"Inkjet printed organic transistors for sustainable electronics"**

Embedded paper electronics is a promising solution for the future of electronics, and thus the goal for this paper is to show the pathway toward achieving inkjet solutions for the realization of complex circuitry on the cheapest synthetic material made by humankind: PAPER. A direct write technology, inkjet printing transfers the designed pattern directly to the substrate. Inkjet technologies have gained a lot of ground as a more accurate and economic fabrication method than traditional lithography. The challenge of this work is to identify the right materials and to show the printability of all the building blocks of an organic field-effect transistor (OTFT). For the semiconductor, a highly soluble pentacene precursor, 13,6-N-Sulfinylacetamidopentacene, is proposed. Anisole, a high boiling point solvent is chosen to insure proper jetting of the solution. The solution jets well and it has to be used right after preparation as its printability degrades with time. For the gate dielectric, two solutions are proposed: (i) using the paper itself as an insulator and print a bottom gate device on both sides of a double sided glossy paper, (ii) a pentacene impurity, of 6,13-pentacenequinone (PQ), in a top gate configuration, which may improve the device mobility by reducing the scattering sites at the semiconductor-dielectric interface. For the electrodes, a printable nano-particle based silver ink has to be modified to match the work function with pentacene, or replaced with an alternate printable material like Carbon Nanotubes (CNTs). Preliminary electrical



testing of the pentacene film printed directly on paper shows good conduction properties for a 25  $\mu\text{m}$  channel length. Further improvement of the pentacene film performance is proposed. This work establishes the foundation for the first fully printed OTFT on paper. [C236]

#### "Advanced trench filling process by selective copper electrodeposition for ultra fine printed wiring board fabrication"

A trench filling type process to fabricate ultra-fine pitch printed wiring boards was developed by combining nano-imprint lithography (NIL) and selective copper deposition. Copper was electrodeposited selectively inside the trenches fabricated in the dielectric layer by NIL process, without causing excess deposition on the surface. The selective deposition was realized by a novel electrodeposition bath employing Cyanine dye as an inhibiting additive. The recessed interconnections with 10  $\mu\text{m}$  line and space dimension were successfully fabricated. The developed process shows significant advantages to the processes employing non- or less- selective deposition, which require planarization to remove excess copper deposited on the surface, and may potentially replace the state of the art semiadditive process. [C237]

#### "Near-eutectic Sn-Ag-Cu solder bumps formation for flip-chip interconnection by electrodeposition"

As one of the most promising lead-free solder candidates for electronics interconnection, eutectic Sn-Ag-Cu alloys are receiving increasing interest due to their merits of low melting temperature, solderability, and reliability. Meanwhile, solder bumping on wafers is of great significance for flip chip interconnection technology which requires fine-pitch, high density bonding for the demands of future interconnection. In the current study, a process of electrodepositing near-eutectic Sn-Ag-Cu alloys was investigated. The electrochemical characteristics of the electrolyte developed were initially measured by cathodic potentiodynamic polarisation. The compositions of electrodeposits were revealed by wave-length dispersive microscopy (WDS), and the surface morphologies of deposits were characterised through scanning electron microscopy (SEM) and atomic force microscopy (AFM). X-ray diffraction (XRD) results indicated that  $\beta$ -Sn,  $\text{Ag}_3\text{Sn}$  and  $\text{Cu}_6\text{Sn}_5$  were present in the as-electroplated film. In addition, dual-beam focused ion beam (FIB/SEM) and transmission electron microscopy (TEM) further elaborated the microstructure of deposits at a nano-scale. As a result, near-eutectic Sn-Ag-Cu deposits with a fine-grained smooth surface were achieved, and the proposed bath chemistry proved capable of producing fine pitch near-eutectic Sn-Ag-Cu solder bumps through demonstration on a test wafer. [C238]

#### "Lattice deformation of Sn nanowires for the application to nano-interconnection technology"

Nano-interconnection technology is expected to replace some part of solder bump technology of electronic packaging in near future. Metallic nanowires (NWs) are one of the candidates for the electrical interconnection materials. In this study, as a well-known material for the interconnection in the electronic packaging, Sn was selected for the application to nano-interconnection technology. Since the physical properties of Sn NWs are important for the interconnection applications, we have already reported the size-dependency of melting behaviors and lattice parameters of single crystalline Sn NWs. In this study, the effects of the NW microstructure and the kinds of templates, which were used for the growth of Sn NWs, on the lattice parameter were investigated. Results showed that the single crystalline Sn NWs were elongated along the longitudinal direction up to 0.64 % depending upon their microstructures and kinds of the templates. The nanowire elongation was gradually reduced when the NW microstructure were single crystalline, granular, and bamboolike structures, in sequence. [C239]

#### "Adhesion improvement for polymer dielectric to electrolytic-plated copper"

Copper is one of the common metals used in the semiconductor backend process and wafer level packaging. A photo definable polymer layer is usually used to passivate the Cu metal. Acceptable adhesion between the polymer layer and Cu is a very important factor to achieve high reliability for the IC component. The purpose of this paper is to investigate how to improve the adhesion strength between spin-on polymer dielectric material and electrolytic-plated Cu. Because adhesion strength is affected by the type of metal surface treatment prior to polymer coating, it is important to find a practical method for Cu surface treatment wafer process. Three types of treatment methods, including plasma, thermal, and wet process, were tried on the plated Cu surface. X-ray photoelectron spectroscopy (XPS) results are reported for the surface properties after treatment. Adhesion strength between the polymer layer and the Cu surface is reported as measured by manual tape, nano-indentation scratch, and four-point bending methods. Our results show that cleaning the Cu surface with dilute acetic acid significantly increases the adhesion between Cu and the polymer layer. We also report results for the change in Cu surface properties as a function of time after clean. [C240]

#### "Modeling of work-function fluctuation for 16 nm FinFET devices with TiN/HfSiON gate stack"



The work-function fluctuation (WKF) induced threshold voltage variability ( $\sigma V_{th}$ ) in 16-nm-gate bulk FinFET devices is for the first time explored and modeled by an experimentally validated Monte Carlo simulation approach. A comprehensive analysis of variability sources of FinFETs is first conducted to show the significance of WKF in reliability of nano-device. Then, the influences of grain size of metal and aspect ratio of device geometry on  $\sigma V_{th}$  are drawn. The analytical expression of WKF-induced  $\sigma V_{th}$  can outlook the effectiveness of the fluctuation suppression approaches and benefits the design of nanoscale transistors. [C241]

### "DNA Nano array analysis using hierarchical quality threshold clustering"

DNA Nano array technology is a challenging area in bioinformatics research, as we have to monitor millions of genes simultaneously. The expression profile of the gene can be useful in cancer disease analysis and its diagnosis. Gene expression data is very voluminous and very difficult to analyze. Several clustering algorithms have been proposed to identify co-expressed genes. The Self-organizing-maps (SOM) is a powerful tool for recognizing and classifying features in complex, micro array data. But the interpretation of co-expression of genes heavily depends on domain knowledge and SOM lacks since the number of clusters must be determined before training. In this work we have proposed dynamically Growing Hierarchical Self Organizing Map (DGHSOM) with Nano array to identify co-expressed genes. The DGHSOM overcomes the problem of specifying the number of clusters and total number of iteration before the processing now, we are using QT (quality threshold) clustering is a method of partitioning data, which is invented for gene clustering. It requires more computing power than A-means, but does not require specifying the number of clusters. [C242]

### "Effects of the lunar environment on space vehicle surfaces"

On the lunar surface there exists very localized and weak magnetic fields, leaving its surface essentially directly exposed to the impact of solar UV and X-rays as well as solar wind plasma and energetic particles. The lack of atmosphere results in a lunar environment charging positive in sunlight and negative in shadow regions resulting in potentials that can vary over orders of magnitude in response to changing solar illumination and plasma conditions. At the macro-scale, contaminant adhesion due to van der Waals' forces are very small and can be easily perturbed by other external forces. However, at the nano-scale, van der Waals forces can be significant. Lunar regolith or dust contamination is a serious problem for equipment and vehicles for space mission applications. Dust contamination gathers on photonic sensors inhibiting motion and data gathering. In addition, devices that require transparency to light for maximum efficiency such as solar photovoltaic power systems, video cameras and optical or infrared detectors will suffer from the dust accumulation. The electrostatic charging of the lunar surface is caused by its interaction with the local plasma environment and solar UV and X-rays induced photoemission of electrons. The lunar thermal environment poses unique challenges to vehicle and sensor surfaces since it is characterized by large temperature variations, long hot and cold soak times, and reduced heat rejection capability due to the presence of the lunar regolith. Fundamental forces (van der Waals) that allow certain contamination to adhere to critical surfaces and methods are being tailored to make these surfaces suitable for this harsh environment. [C243]

### "60-GHz transceivers for wireless HD uncompressed video communication in nano-era CMOS technology"

This paper reports the system-level study of high-speed wireless system at 60 GHz for uncompressed HD video communications. The study is addressed to explore the implementation of 60-GHz transceivers in nano-scale CMOS technology. A model of the high data rate physical layer based on the specification released by the consortium WirelessHD® has been implemented in MATLAB® and the system simulations of the bit error rate have been carried out in order to derive the specifications of the building blocks of the 60-GHz transceiver. Finally, these specifications have been derived by taking into account the capabilities of the 65 nm standard CMOS technology. [C244]

### "Power improvement for 65nm nMOSFET with high-tensile CESL and fast nonlinear behavior modeling"

In this paper, the power gain improvements by stress contact etch stop layer (CESL) in a 65-nm nMOSFET were studied. Compared to the conventional nMOSFET, the device with CESL stress shows an extra 6% power gain enhancement for the increased stress in the channel region. This study also presents the polyharmonic distortion (PHD) model extraction by X-parameters measurement when the power transistor was designed to work far from 50 ohms. By mean of this model, the accurate nonlinear behaviors of nMOSFET were obtained rapidly. [C245]

### "Reliable bounds for the propagation delay in VLSI nano interconnects based on Multi Wall Carbon"



### **"Nano Tubes"**

The upper and lower bounds of the time-delay due to the variations of some physical and geometrical characteristics of a nano-interconnect based on Multi Wall CNTs, suitable for the 32 and 22 nm technology, are evaluated. Interval Analysis is used to define the ranges of the of the p.u.l. parameters of a Transmission Line modeling the interconnect. The Vertex Analysis is then exploited on the parameter space to obtain in a reliable way the time-delay bounding without extensive and costly simulation burden. The obtained results are compared with those of scaled down copper-based structures. [C246]

### **"Applications of MEMS actuators in micro/nano robotic manipulators"**

Micro/nano robotic manipulators have the ability to position and orient objects at the micro/nano scales and are capable of performing very small motion with high resolution. The performances of micro/nano robotic manipulators greatly influence on the reliability and efficiency of the entire system. Furtherly, the positioning and orientation of micro/nano robotic manipulators depend largely on their actuators. So the miniaturized actuators are vital for the operation of micro/ nano manipulators. With the reduction of object sizes to micro/nano scale, several predominate physics such as surface and intermolecular forces become more significant and various physical effects appear. Combined with the micro electromechanical systems(MEMS) technologies, some MEMS actuators utilizing the piezoelectric effect, shape memory alloy(SMA), electromagnetic effect, electrostatic effect, thermal deformation and so on have been available and applied now. This paper focuses on the basic MEMS actuation technologies and their applications at micro/nano robotic manipulators. [C247]

### **"Analysis of SRAM Reliability under Combined Effect of NBTI, Process and Temperature Variations in Nano-Scale CMOS"**

As dimensions of MOS devices have been scaled down, new reliability problems are coming into effect. One of these emerging reliability issues is aging effects which result in device performance degradation over time. NBTI (Negative biased temperature instability) is a well known aging phenomenon which is a limiting factor for future scaling of devices. NBTI results in the generation of trapped charges which cause  $V_t$ (threshold voltage) degradation of PMOS. It is observed that a sharp  $V_t$ shift occurs in just a few seconds after turning on the MOSFET. In nano-scale CMOS technologies, process (threshold voltage) and temperature variations are also crucial reliability concerns. On the other hand, NBTI itself is dependent on temperature and threshold voltage. In this paper, the combined effect of NBTI, process and temperature variations on the reliability of the 6T SRAM (Static Random Access Memory) in 32nm CMOS technology is analyzed. It is observed that: (1)  $V_t$  abruptly increases initially and afterwards  $V_t$ shift is very small, even for prolonged time; (2) Low  $V_t$  transistors age faster than high  $V_t$  transistors; and (3) NBTI  $V_t$ degradation is more significant at higher temperature. Along with these observations, we also quantified our results in terms of number of faulty cells in SRAM array. It is observed that: (1) number of faulty cells rises over time (8.2% rise in faulty cells for the inter-die nominal  $V_t$  chip over 2 years) due to SNM degradation; (2) rise in the number of faulty cells over time due to write failures under NBTI effect is practically negligible; (3) Leakage (in the worst case condition) and access time are not impacted by NBTI.

[C248]

### **"Architecture-Aware Graph-Covering Algorithm for Custom Instruction Selection"**

Application-specific extensions to the computational capabilities of a processor provide an efficient mechanism to meet the growing performance demands of embedded applications. In recent customized processors, hardware in the form of new function units and the corresponding custom instructions are added to a core processor to meet the critical computational demands of a target application. This paper presents a new method for automatic selection of application-specific processor extensions. We demonstrate the effectiveness of this system across a range of application domains. Our investigations show that considering the architectural constraints in the custom instruction selection leads to improvements in the total performance of the application. Simulations based on domain-specific application benchmark suites show that with the proposed technique, up to 10% performance improvement can be achieved over the traditional graph covering method. [C249]

### **"Thermal performance enhancement by exploitation of nano-effects"**

Thermal interface material resistance is one of the bottlenecks for efficient thermal management. Much research has been undertaken in the last years to overcome the finite thermal conductivity as well as the interface resistance of, above all, polymer-based TIMs varying material parameters such as filler particles material, size and modality as well as matrix material properties. Some improvement has been achieved, however, heat transport mechanisms on the continuum and nano scale, theoretical limits under technological and application-relevant boundary conditions need to be understood and used for the optimization of materials and processes. This paper addresses advancements in advanced thermal technology with respect to TIMs for die-attach and



related characterization methods. Some of the work presented will be based on the results of the currently running EC-Project "Nanopack". [C250]

#### **"Numerical investigations of the strain behavior in nanoscale patterned strained silicon structures"**

The physical properties of materials can be manipulated by applying stress or strain. For instance, the controlled introduction of strain in silicon (Si) devices was found to increase the charge carriers mobility and modify the Si optical properties. The exploitation of this potential technology raises fundamental questions on strain and stress stability and behavior during the fabrication and processing of strained Si devices. In this paper, we address this issue and provide detailed three-dimensional finite element simulations of strain redistribution upon nanoscale patterning that is a crucial step in the fabrication of devices. The shown calculated results give valuable insights into the relaxation phenomenon of nano-scale strained silicon mesa-structures and point out ways to modify the strain field in one-dimensional optical micro-cavity waveguides based on photonic crystal designs. Our calculations are augmented by experimental data obtained by UV Raman spectroscopy analysis. [C251]

#### **"Compact model of memristors and its application in computing systems"**

In this paper, we present a compact model of the spintronic memristor based on the magnetic-domain-wall motion mechanism for circuit design. Our model also takes into account the variations of material parameters and fabrication process, which significantly affects the actual electrical characteristics of a memristor in nanoscale technologies. Our proposed model can be easily implemented by Verilog-A languages and compatible to SPICE-based simulation. Based on our model, we also show some potential applications of memristor in computing system, including the detailed analysis and optimizations based on our proposed model. [C252]

#### **"Error resilience of intra-die and inter-die communication with 3D spidergon STNoC"**

Scaling down in very deep submicron (VDSM) technologies increases the delay, power consumption of on-chip interconnects, while the reliability and yield decrease. In high performance integrated circuits wires become the performance bottleneck and we are shifting towards communication centric design paradigms. Networks-on-chip and stacked 3D integration are two emerging technologies that alleviate the performance difficulties of on-chip interconnects in nano-scale designs. In this paper we present a design-time configurable error correction scheme integrated at link-level in the 3D Spidergon STNoC on-chip communication platform. The proposed scheme detects errors and selectively corrects them on the fly, depending on the critical nature of the transmitted information, making thus the correction software controllable. Moreover, the proposed scheme can correct multiple error patterns by using interleaved single error correction codes, providing an increased level of reliability. The performance of the link and its cost in silicon and vertical wires are evaluated for various configurations. [C253]

#### **"Test structures for characterising the integration of EWOD and SAW technologies for microfluidics"**

This paper presents details of the design and fabrication of test structures specifically designed for the characterisation of two distinct digital microfluidic technologies: Electro-Wetting On Dielectric (EWOD) and Surface Acoustic Wave (SAW). A test chip has been fabricated that includes structures with a wide range of dimensions and provides the capability to characterise enhanced droplet manipulation as well as other integrated functions. In particular, we detail the use of EWOD to anchor droplets while SAW excitation is applied to perform mixing. [C254]

#### **"On-the-fly variation tolerant mapping in crossbar nano-architectures"**

In hybrid nano-architectures, self-assembled nanoscale crossbars are fabricated on top of a reliable CMOS subsystem. Bottom-up self-assembly nanofabrication process, used in nano-architectures, yields nanodevices with significantly more variations compared to the conventional top-down lithography used in CMOS fabrication. This is in addition to an increased defect density expected for self-assembled nanodevices. Therefore, it is one of the major design challenges to tolerate variation and defects in emerging nano architectures. In this paper, we present an alternative approach for variation and defect tolerant mapping in which no application-independent test and characterization (defect and variation map) is required. The variation tolerant mapping is done on-the-fly which can ultimately be transformed into built-in self-mapping. Different mapping algorithms are presented and their efficiencies in terms of variation and defect tolerance as well as mapping time are compared. The experimental results show that the proposed heuristic mapping algorithm can achieve the same success rate with the exhaustive method in terms of meeting required timing constraints with orders of magnitude fewer reconfiguration retries. [C255]



### "Crack and damage in low-k BEoL stacks under assembly and CPI aspects"

Miniaturization and increasing functional integration as the electronic industry drives push the development of feature sizes down to the nanometer range. Moreover, harsh operational conditions and new porous or nano-particle filled materials introduced on both chip and package level-low-k and ultra low-k materials in Back-end of line (BEoL) layers of advanced CMOS technologies, in particular-cause new challenges for reliability analysis and prediction. The authors show a combined numerical/experimental approach and results towards optimized fracture and fatigue resistance of those BEoL structures under manufacturing/packaging (during lead-free reflow-soldering, in particular) as well as chip package interaction (CPI) aspects by making use of bulk and interface fracture concepts, in multi-scale and multi-failure modeling approaches with several kinds of failure/fatigue phenomena. Probable crack paths and interactions between material damaging and interface fracture will be investigated and sensitivities with regard to structural modifications studied. Complementary to the simulation side of reliability estimations, serious issues are connected with the collection of appropriate material properties in the miniaturized range addressed-Young's modulus, initial yield stress, hardening. Nano-indentation, AFM, FIB and EBSD provide these desired properties, in particular. In addition, manufacturing induced residual stresses in the Back-end layer stack have an essential impact on damage behavior, because they superpose functional and CPI loads. Their determination with a spatial resolution necessary for typical BEoL structure sizes is a critical issue. The nano-scale stress relief technique (fibDAC) makes use of tiny trenches placed with a focused ion beam (FIB) equipment at the position of stress measurement. Digital image correlation algorithms applied to SEM micrographs captured before and after ion milling allows to conclude on stresses released. Residual stresses can be computed with the help of appropriate, adjusted FEA models. [C256]

### "Nano-engineered optical fibers and applications"

This paper reviews a technology for making nano-engineered optical fibers. Key features and advantages of nano-engineered glass fibers are discussed. Fiber designs and their applications are presented. [C257]

### "Trends and challenges of SRAM reliability in the nano-scale era"

According to the International Technology Roadmap for Semiconductors (ITRS), embedded Static Random Access Memory (SRAM) will continue to dominate the area of System on Chips (SoCs) approaching 90% in the next 10 years. Therefore, SRAM reliability will have a significant impact on overall SoC reliability. This paper presents state-of-the-art transistor failure mechanisms and their impact on SRAM reliability parameters including cell stability, cell read failures, and cell access time failures. Furthermore, different techniques currently employed in industry, to mitigate the impacts of the failure mechanisms are presented. Finally, based on the current scaling trends reliability challenges of future transistors and embedded SRAM are discussed. The discussion concludes that the reliability challenges in future embedded SRAM will increase significantly. [C258]

### "Technology challenges for deep-nano semiconductor"

The rapid evolution of flash memory technologies in the previous decade has been achieved through the two distinctive ways; overcoming the scaling challenges and devising multi-bit cell transistors. The scaling challenges such as cell-to-cell interference, cell programming disturbance and patterning limit have been tackled with several breakthroughs; incorporating low-k material, relieving the stress on tunnel oxide and double patterning technology (DPT). Multi-bit cell transistors have multiplied the chip density up to 4 times with the new circuit technology and the controller algorithms. And now, the key technology in the sub-20nm technology region is finding how to integrate all the available solutions of process, device, circuit and controller issues with the most efficient ways. In the aspect of integrating each technology, we discuss technical scaling barrier in sub-20nm region and present the future candidate for high-density devices. [C259]

### "High fault tolerance in neural crossbar"

Proposed nanometer-scale electronic devices are generally expected to feature an increased probability of manufacturing defects. We present in this paper a novel, highly fault-tolerant architecture, based on memristor crossbar architecture that may enable reliable implementation of neural network. Simulation results of our learning method inspired of Delta rule for monolayer crossbar, exhibits very fast convergence rate to learn Boolean functions. In addition we simulate the impact of defects to measure the ability of our architecture to repair defective neurons, using a competitive learning scheme with or without redundancy. The architecture is able to learn the Boolean functions with manufacturing defect rate up to 13% with reasonable redundancy amount. It shows the best fault-tolerance performance comparing with the other techniques like RMR, von Neumann multiplexing and reconfiguration. [C260]



### "Neuro-inspired learning of low-level image processing tasks for implementation based on nano-devices"

As nanoscale devices such as OG-CNTFETs are under studies and may be used in a near future, we choose to investigate in which application domain such components may be of the most interest. In this paper we present how neural networks can be used to implement functions on nano-scale components. This method has been tested in the image processing application field. [C261]

### "Mature processability and manufacturability by characterizing VT and Vmin behaviors induced by NBTI and AHTOL test"

A systematical reliability assessment for technology process that is essential for technology feasibility and qualification is presented by addressing physical and electrical characterization and reliability evaluation. By varying the duty cycle of enhanced pulsed radio frequency (ep rf) technique used for the gate oxynitridation, the effects of nitrogen concentration and profile at SiO<sub>2</sub>/Si interface on VT and Vmin shift of thin oxide pMOSFET (~20A) and SRAM, which result from negative bias temperature stability (NBTI) and accelerated high temperature operating life (AHTOL) stress test, are meticulously investigated. Using secondary ion mass spectrometry (SIMS) and high resolution Rutherford back scattering (H-RBS), nitrogen concentration and profile at the interface are carefully characterized. It is found that pMOSFET device processed with 10% of ep rf provides ~24 longer NBTI lifetimes than with 20% of ep rf due to lower nitrogen concentration at the interface. Furthermore, Vmin shift of SRAM with 10% of ep rf, which is caused by AHTOL test conditioned at 140°C with 1.44 Vdd, is ~3~4 less than with 20% of ep rf. In fact, a nano-probing technique elucidates that Vmin shift is mainly attributed to the mismatch of VT between pull-up (PU) transistors in SRAM induced by NBTI stemmed from AHTOL test. It is also empirically shown that Vmin shift behavior is in good agreement with the read margin rather than the write. Accordingly, a stabilized Vmin drift behavior consistently adheres to the write margin. Hence, the optimization of interfacial nitrogen concentration results in less pMOSFET NBTI degradation so as to efficiently suppress Vmin shift of SRAM. Besides, increasing PU transistor size that decreases the  $\gamma$  value (the ratio of I<sub>on</sub> current of PG to PU) can also reduce Vmin shift during AHTOL test. Finally, mature processability and manufacturability are attained by characterizing VT and Vmin behaviors for pMOSFET and SRAM from the front-end-of-line (FEOL) process optimization and SRAM bit-cell design aspect. [C262]

### "Nano-electronics of high k dielectrics on exotic semiconductors for science and technology beyond Si CMOS"

We have achieved high device performance in self-aligned inversion-channel InGaAs MOSFETs, as well as a CET of < 1 nm, a D<sub>it</sub> ≤ 10<sup>11</sup> eV<sup>-1</sup>cm<sup>-2</sup>, and high-temperature thermal stability withstanding >850°C RTA in GGO and a CET of < 1 nm in ALD-HfO<sub>2</sub> on InGaAs. Remarkable device performances in self-aligned, inversion-channel Ge MOSFET using GGO without any interfacial passivation layers (IPLs), and inversion-channel and accumulation type GaN MOSFET's with high k's as gate dielectrics have also been attained. Interfacial characteristics including energy band parameters were studied using x-ray photoelectron spectroscopy (XPS). [C263]

### "Title page"

The following topics are dealt with: nonvolatile memories; deep-nano semiconductor; mobile application; phase-change memory devices; ferroelectric NAND flash SSD; and logic CMOS process. [C264]

### "Electromigration of NiSi poly gated electrical fuse and its resistance behaviors induced by high temperature"

Insight is given on improved behaviors of the programmed NiSi polygated electrical fuse (eFuse) during the high temperature storage (HTS) test. By using a noble transmission electron microscopy (TEM) that includes scanning transmission electron microscopy (STEM), energy dispersive x-ray spectrometry (EDS), electron energy loss spectrometry (EELS) and nano-beam electron diffraction (NBED), microstructural behavior and phase transition of NiSi in the fuse link are painstakingly investigated before and after HTS test. It is found that improved post-resistance of eFuse is attributed to the low temperature growth of Ni<sub>3</sub>Si<sub>2</sub> induced by HTS test at 250°C, which is microscopically proven by both ex-situ and in-situ TEM. In fact, Ni agglomeration, in which Ni resides around void formed in the fuse link, plays an important role of this crystallization. As results, the root causes of improved post-resistance of eFuse are qualitatively substantiated with respect to dynamic phase transformation and microstructural change in the fuse link. [C265]

### "Nano Air Vehicle wing concepts design and experimental study of nano rotor hovering"



### performance"

Nano Air Vehicles (NAVs) were proposed as unmanned aerial robots to fulfill the missions in cluster environment. This study designs two types of wing concept as rotary wing and flapping wing for NAV based on the minimum energy loss theory and biologically inspired theory. The hovering performance of the two concepts is compared each other to demonstrate the concept superiority. And the experimental study of nano rotor hovering performance is carried out. A test bench with highly sensitive mechanism systems is designed in view of being able to measure the thrust and torque of nano-rotors simultaneously and response to the change of variables rapidly with sufficient accuracy. Then experimental and computational studies are performed with a micro brushless motor and a nano rotor. The results of concept design show that the flapping-wing concept is slightly more efficient than the rotary-wing concept base on the hovering power. The analysis of experimental and computational studies suggests that the motor efficiency and rotor efficiency degrade dramatically with the reduction of motor and rotor size. [C266]

### "Partner selection of virtual enterprise using two-layer ant colony optimization"

To improve the partner selection quality of virtual enterprise (VE), an improved ant colony optimization (ACO) named two-layer ACO (TL-ACO) was proposed in this paper. According to the features of partner selection, TL-ACO divided each selection step into two stages and each stage was given independent pheromone and visibility. As a result of that, the objective function could be much simpler than if original ACO was used, and the local optimum solution can be easily avoid by using the local obstruction (LO) method which was developed based on bionics. The simulation experiment manifested that the TL-ACO was effective and high-efficiency. [C267]

### "Development of CAPP based on 2.5D machining feature recognition"

This paper proposes an architecture of CAPP based on machining feature recognition. The key techniques such as machining feature recognition, process planning optimization are discussed. In order to recognize the machining feature, the edges are divided into two types: convex Edge and concave Edge. The machining features are divided into four types: AOMF, HOMF, BCMF, and TCMF. The recognition process of the basic machining feature and the interactive process are given. Process planning optimization is to optimize the operation order and the machining resource. A mathematical model for process planning is given. A prototype is developed, and a example part is used for test. [C268]

### "The stem-based vector space model for automatic resource allocation in workflow"

In the context of workflow, resource allocation is often performed manually and empirically. In this paper, we present a novel approach based on stem-based vector space model (VSM) to automate the resource allocation works. The VSM similarity is utilized to compute the cohesion measures between the resources and the tasks, and the cohesion measures are then used to rank the resource candidates, and the resource with the highest score will be allocated to the specific workflow task. The initial evaluation on our experiments shows that our method can efficiently predicate the performers for the workflow tasks with good precision. [C269]

### "Fabrication of a novel microcantilever probe with inverted pyramidal microdischarge for maskless scanning plasma etching"

This paper presents a novel maskless microplasma etching method based on scanning probe microscopy. That is, an inverted pyramidal microdischarge is integrated into a hollow tip of a SiO<sub>2</sub> cantilever probe, and the generated microplasmas are ejected through the nano -aperture to realize maskless etching with nano -resolution and high efficiency. The SiO<sub>2</sub> cantilever with microdischarge and nano-aperture at the hollow tip is designed and successfully fabricated with good quality. Experiment results show that the devices can discharge in SF<sub>6</sub> gas stably. The electrical and optical characteristics of the microdischarge in SF<sub>6</sub> at the pressure of 3kPa~15kPa are obtained. The simulation result of etching mechanism verifies the feasibility of silica-based material maskless etching. [C270]

### "Continuous nano/micro-machining and weaving integration process for fiber substrates"

We report on the reel to reel process including coating and patterning fibers and their weaving integration process for the application to large area (> 1 m<sup>2</sup>) MEMS devices. Firstly, large area applications are discussed and the difficulty to apply MEMS process to meter-scale devices regarding on throughput and high-cost of materials are pointed out. Secondly, toward high throughput processing, we proposed the die-coating technology applied to plastic fibers and the weaving of them, forming large area-device. To solve the high cost of materials, we proposed to utilize plastic fiber substrates and organic electronic material as low cost materials. Thirdly, we



established the device fabrication process and fabricated a 30 cm Ч 30 cm pressure sensor array. Finally, its mechanical and electrical properties were examined and pressure sensing was demonstrated using fabricated device. The developed process will lead to large area pressure sensors and other electronic devices. [C271]

#### **"Photonic micromachined tunable lasers"**

This paper covers design, fabrication, packaging and experiments of photonic Microelectromechanical Systems (MEMS) tunable laser sources. Two different types of MEMS tunable lasers, which are MEMS coupled-cavity lasers and dual-wavelength tunable lasers, are demonstrated as examples of natural synergy of MEMS with photonics. The expansion and penetration of the MEMS technology to silicon nano-photonics creates on-chip optical systems at an unprecedented scale of integration. While producing better integration, robustness and compactness, MEMS improves the functionalities and specifications of laser devices. Additionally, MEMS photonic tunable lasers are able to deliver their merits of small size, fast tuning speed, wide tuning range and CMOS compatible integration which broaden their applications to many fields. [C272]

#### **"Replication of micro and sub-micro structures by means of hot embossed polymer inserts"**

Hot embossing enables accurate replication of polymer structures in a broad variety of polymers even in the range of micro- and nanometer. Comparatively long cycle times and high insert costs however limit the further distribution of hot embossed parts. The use of hot embossed polymer inserts for subsequent replication can improve the through-put of replicated parts and reduces the costs for fabricating several metal inserts. Investigation of material combinations for replication of micro-structured parts by hot embossed interstage inserts showed the suitability for a wide range of polymers. The stability of embossed polymer inserts for tens of replications has been proved. This technology showed a big advantage of using hot embossed polymer inserts for low volume production of micro- and nano-structured polymer parts. [C273]

#### **"Modeling and thermal analysis of silicon infrared emitter based on SOI wafer"**

Silicon infrared emitter was a key component in the infrared gas detection systems. In this paper, finite element thermal-electric simulation in ANSYS is used to simulate polysilicon infrared emitters based on silicon on insulator (SOI) technology. In the simulation, silicon infrared emitters were studied with respect to power consumption, response time, surface temperature distribution and thermal induced stress. Based on the results and discussion, a new bridge structure is proposed in order to optimize device performance. [C274]

#### **"Spheres on pillars: Nanobubbling based on attogram mass delivery from metal-filled nanotubes"**

We report an experimental investigation into the controlled fabrication of metallic nanospheres on the tip of nanotubes. The fabrication process, nanobubbling, is based on nanofluidic mass delivery at the attogram scale using metal-filled carbon nanotubes (CNTs). Two methods have been investigated including electron-beam-induced bubbling (EBIB) and electromigration-based bubbling (EMBB). Under the irradiation of a high energy electron beam of a transmission electron microscope (TEM), the encapsulated metal is melted and extruded out from the tip of the nanotube; generating a metallic sphere. Our investigation showed that several factors including temperatures, nanotube tip breaking/opening, and electron-beam-induced reconstruction of the carbon shells are responsible to the sizes and shapes of the metallic spheres on the nanotubes. In the case that the encapsulated materials inside the CNT has a higher melting point than that of the beam energy can reach, electromigration-based mass delivery is an optional process to apply. Results show that under a low bias (2-2.5V), spherical nanoparticles can be formed on the tips of nanotubes. EMBB is a further development of the nanorobotic spot welding technique and a fundamental technology for thermal dip pen nanolithography. The sphere-on-pillar structures and the nanobubbling processes proposed will enable devices such as nanooptical antennas, scanning near-field optical microscope (SNOM) probes, scanning anodes for field emitters, and single molecule detectors, which can find applications in bio-sensing, molecular detection, and high-resolution optical microscopy. [C275]

#### **"Effect of redeposition-An important consideration in existing mathematical model of sputtering process in focused ion beam milling"**

Microchannels with nano level accuracy have found their applications in almost all fields of research. In this paper, efforts have been made to generate sine wave and rectangular cross sections of microchannels using an existing mathematical model of depth of sputtering in focused ion beam (FIB) milling process. The existing mathematical model to calculate the depth of sputtering finds deviation from experimental data due to effect of redeposition, which has not been incorporated into it. A modified mathematical model, which incorporates the effect of redeposition via a ratio of redeposition to beam velocity, has been proposed in this paper. Normalized pixel spacing is another parameter, which has also been newly considered in modified mathematical model.



Modified mathematical model has been simulated for sinusoidal and rectangular cross sectional profiles of microchannels and it has been proven more accurate than existing mathematical model through the comparison with experimental data of sinusoidal and rectangular geometry on Si material. [C276]

#### "TiO<sub>2</sub> nanoparticle generation by flame pyrolysis FFESS system"

Generation of TiO<sub>2</sub>nanoparticles is demonstrated by using a flame pyrolysis FFESS system which combines flame aerosol synthesis with the flow-limited field-injected electrostatic spraying (FFESS) technique. In this work, well-dispersed TiO<sub>2</sub>nanoparticles are generated without particle coalescence, which are well-suited for forming high surface area porous TiO<sub>2</sub>nanoparticle networks for photocatalysts and nano structured solar cells such as dye-sensitized solar cells. Flame pyrolysis FFESS generates TiO<sub>2</sub>nanoparticles exhibiting a narrow size distribution, and can control the ratio of anatase and rutile phase. The results demonstrate that flame pyrolysis FFESS is a promising technology for enabling more versatility in generating nanostructures of various materials. [C277]

#### "Cutting graphene using an atomic force microscope based nanorobot"

Rapid progress in graphene-based applications is calling for an inexpensive technique for creating mass graphene components with specialized shapes, sizes, and edge structures. In this paper, an Atomic Force Microscopy (AFM) based mechanical cutting method is developed to approach this goal, through which we are able to structure trenches into multilayer graphene flakes with different directions, and generate different graphene shapes: graphene nanoribbons and triangles. Combining parallel multi-tip technology, this method makes it possible to fabricate large-scale graphene-based device at low cost and high efficiency. This research also reveals that the cutting force of graphene varies with different cutting directions, based on which a close-loop fabrication method with interaction force as real-time feedback may be developed for tailoring graphene into desired edge structures and shapes in a controllable high-precise way. [C278]

#### "Control the movement of a single dsDNA by DEP"

In this paper we demonstrate the adoption of both electrophoresis (EP) and dielectrophoretic (DEP) forces to control the movement of a single DNA and stretch this DNA as a stretched bridge across two Al metal electrodes at specific positions. The moving speed of the single DNA molecule can also be manipulated from 0.615 to 2.285µm/s inside a nano-pore region by DEP controlling the opening size of the virtual nanopore. The control of stretched DNA linear structure and moving speed will be the first step toward single DNA base pair detection in rapid nano pore DNA sequencing technology in the future. [C279]

#### "Mitigating defective CMOS to Non-CMOS vias in CMOS/Molecular memories"

CMOS/Molecular (CMOL) memory is one of the emerging memory technologies that promises increased data storage, reduced power consumption and minimized fabrication complexity. The fabrication of these memories is based on the stacking of non-CMOS-based memory cell array on the top of CMOS-based peripheral circuits. Similarly to existing 3D technology, vertical vias are utilized to connect the two components. Because of their critical location and small in size, these CMOS to Non-CMOS Vias (CNVs) are prone to fabrication imperfection. A defective CNV may cause inaccessibility to the memory cell array, which in turn decreases the overall yield and/or reliability. This paper presents a modified CMOL architecture that mitigates faults due to defective CNVs. It is based on combining the Redundant Residue Number System (RRNS) error correction code (ECC) and interleaving. The number of banks interleaved in CMOL memories is determined by the ECC capability. Simulation results show that by setting an appropriate ECC capability with the associated number of banks, 95% to 100% mitigation of defective CNVs can be realized. [C280]

#### "Cell-cell adhesion force measurement using nano picker via nanorobotic manipulators inside ESEM"

Cell-cell adhesion force is important for cell activities. In this paper, a novel cell-cell adhesion force measurement method using nano picker was proposed based on the nanorobotic manipulation system inside an environmental scanning electron microscopy (ESEM). The nano picker was fabricated from atomic force microscopy(AFM) cantilever by focused ion beam(FIB) etching. The spring constant of the nano picker was calibrated by nano manipulation approach. The cell which was selected for adhesion force measurement was first positioned on the top of another cell by a micro probe. Then, the nano picker was inserted to the join area between the two cells. Finally, the nano picker lifted the top cell by the actuating of nano manipulator inside environmental scanning electron microscopy ESEM. The cell-cell adhesion force can be measured based on the deflection of the cantilever during the cell separation. This method allowed the observation and manipulation of



cell at nano scale simultaneously. Study of cell adhesion will benefit the understanding the mechanism of cell spreading, proliferation and so on. [C281]

### "Biomarker capturing platform using LC-ESI/MS/MS coupled aptamer microarray"

The sensitive detection of molecular biomarkers in clinical samples is crucially important in disease diagnosis. In this study, we propose and develop aptamer microarray platform combined with novel sol-gel technology to identify low abundance targets from complex solution, such as serum. Due to nanoporous structure of sol-gel, it entraps a large number of active aptamers and allows aptamers to bind target molecules with high sensitivity. TBP (TATA Box Protein) and their specific aptamers (aptamer #12 and #24) were chosen for a model system to a proof of concept. Broad ranges of sensing capability (from few nM to mM) with good linearity up to 400 nM were shown in our aptamer microarray platform by sandwich assay. Moreover, TBP protein can be identified by ESI/MS, electrospray mass spectrometry on the platform. [C282]

### "Nanofork and Line-patterned Substrate for measuring single cells adhesion force inside ESEM"

In this paper, single cell adhesion force was measured using a nanofork. The nanofork was used to pick-up a single cell on a line-patterned substrate inside ESEM. The line-patterned substrate was used to provide small gaps between the single cells and the substrate. Therefore, the nanofork could be inserted through these gaps in order to successfully pick-up a single cell. Adhesion force was measured during the cell pick-up process from the deflection of the cantilever beam. The nanofork was fabricated using focused ion beam (FIB) etching process while the line-patterned substrate was fabricated using nanoimprinting technology. As to investigate the effect of contact area on the strength of the adhesion force, two sizes of gap distance of line-patterned substrate were used, i.e. 1  $\mu\text{m}$  and 2  $\mu\text{m}$ . Results showed that cells attached on the 1  $\mu\text{m}$  gap line-patterned substrate required more force to be released as compared to the cells attached on the 2  $\mu\text{m}$  gap line-patterned substrate. [C283]

### "Design of a reversible single precision floating point multiplier based on operand decomposition"

Reversible logic is a promising field of research that finds applications in low power computing, quantum computing, optical computing, and other emerging computing technologies. Further, floating point multiplication is one of the major operations in image and digital signal processing applications. The single precision floating-point multiplier requires the design of efficient 24x24 bit integer multiplier. In this work, we propose a new reversible design of single precision floating point multiplier based on operand decomposition approach. To design the reversible 24x24 (A4B) bit multiplier (assume A and B are of 24 bits each), the operands are decomposed into three partitions of 8 bits each. Thus, the 24x24 bit reversible multiplication is performed through nine reversible 8x8 bit Wallace tree multipliers, whose outputs are then summed. We propose a new reversible design of the 8x8 bit Wallace tree multiplier that has been optimized in terms of quantum cost, delay, and number of garbage outputs. Wallace tree multiplication consists of three conceptual stages: Partial product generation, partial product compression using 4:2 compressors, full adders, and half adders, and then the final addition stage to generate the product. In this work we perform optimization at each of these three stages. For the first stage, we have proposed a new generalized reversible partial product generation circuitry. For the second stage we have proposed a new reversible 4:2 compressor design for use in the compression tree. Finally, for the summation stage we have carefully chosen and arranged the reversible half adders and full adders in such a way to yield an efficient multiplier optimized in terms of quantum cost, delay, and garbage outputs. We have also illustrated the reversible design of 24x24 bit multiplier using the proposed 8x8 bit reversible Wallace tree multiplier. [C284]

### "Band-level control for high-performance colloidal quantum-dot LED"

Here we report hybrid organic/inorganic quantum-dot LED with high-performance. Use of sol-gel TiO<sub>2</sub> as electron transport layer allows the device to be fabricated with all-solution process and have more efficient energy band structure for carrier injection and confinement. Quantum dot layer was crosslinked and thermally annealed to enhance the device performance. Quantum dot crosslinking not only made all-solution process feasible but also enhanced hole injection by shifting valence band of 0.3~0.6 eV, resulting in better charge balance. The degree of band-level shift depends on the asymmetric adsorption of ligand which might cause the dipole alignment of QD layer through the hole transport. The resulting device showed a high luminance (>10,000 cd/m<sup>2</sup>), low turn on voltage (1.9 V), and the high power efficiency (2.41 lm/W). Incorporation of the technology into a display device with an active matrix drive backplane for the first time suggests that the approach is promising for high performance, easy-to-fabricate, large area displays and illumination sources. [C285]

### "Irreversible bit erasures in binary adders"

The ultra-high density integrated circuits based on nanodevices will suffer from heat dissipation due to



irreversible information erasure, limiting the reachable operating frequencies. This paper studies the amount of logical bits lost in standard binary adder structures, which are shown to be sub-optimal when compared with the theoretical limit. The analysis covers the pipelined ripple carry adder, the carry lookahead adder, and the conditional sum adder proposed for quantum-dot cellular automata implementation. The study focuses on majority logic circuits, available also in many other technologies. [C286]

#### **"Logic circuit synthesis using Threshold Gates based on nanodevices with negative differential resistance property"**

Electronic circuits based on nanodevices and quantum effect can be the future of logic circuits design. Today's technology enables to construct nanodevices that are elementary components of threshold gates, however, constructing threshold gates given arbitrarily Boolean function is still a challenging task, with no efficient algorithms for some gate structures. This paper focuses on Generalised Threshold Gates (GTGs) and Multi Threshold Threshold Gates (MTTGs), giving the overview of threshold circuit synthesis. We present general structure of both circuits and describe ideas of different synthesis algorithms. [C287]

#### **"6 inch full field wafer size nanoimprint lithography for photonic crystals patterning"**

The HB-LED market grew rapidly in the last years and will see greater than 50% growth this year. The current applications are dominated by portable device backlighting, e.g. cell phones, PDAs, GPS, laptop etc. In order to open the general lighting market doors the luminous efficiency needs to be improved significantly. Photonic crystal (PhC) structures in LEDs have been demonstrated to enhance light extraction efficiency on the wafer level by researchers. However, there is still a great challenge to fabricate PhC structures on LED wafers cost-effectively. Nanoimprint lithography (NIL) is one promising technology for manufacturing of electronic devices of low nm scale. However, the current NIL techniques with rigid stamps rely strongly on the substrate flatness and the production atmosphere. UV-NIL with flexible stamps, e.g. PDMS stamps, allows the large-area imprint in a single step and is less-sensitive to the production atmosphere. Unfortunately, the resolution is normally limited due to stamp distortion caused by imprint pressure. The NIL technique developed by Philips Research and SUSS MicroTec, substrate conformal imprint lithography (SCIL), bridges the gap between UV-NIL with rigid stamp for best resolution and soft stamp for large-area patterning. [C288]

#### **"Nanoassembly of pH sensor nanoprobe by multiple-metallic nanowires"**

This paper presents the assembly of a nanowire probe pH sensor. An AFM cantilever was used for electrodes of the device and etched by FIB. Two carbon nanotubes (CNT) were assembled to the separated electrodes of AFM cantilever. A tungsten probe is etched by focused ion beam (FIB) into 300 nm in diameter and 25.4  $\mu\text{m}$  in length. Then the probe is coated by parylene and cut the tip to open the tungsten. A tungsten nanowire is used for work electrode and a platinum nanowire is used for counter electrode. The nanowires were fabricated via field emission method by introducing hexacabonyl tungsten and trimethyl cyclopentadienyl platinum individually inside a field emission electron microscope. [C289]

#### **"Modeling and analyzing nano-rod pushing with an AFM"**

In developing nano-devices and nano-structures, traditional methodologies on MEMS meet the difficulty from the scale restriction. With the strategy of objects assembly, using AFM to handle nano-rods and other nano-objects is considered as an important and high potential technology in constructing nano-structures. However most of AFM only has one tip as the end effector and cannot control both translational and rotational motions during manipulation, this makes it be difficult to realize posture controllable manipulation especially in nano environment. In this paper, the behavior of nano-rod under pushing is theoretically analyzed and modeled. Viscous friction is incorporated in the model and the two situations that the pivot of the nanorod is either inside or outside the rod are addressed. By modeling, the pivot can be determined at each manipulation in real time, and the pushing points can be planned to realize posture controllable manipulation by using nano-hand strategy which is inspired by stable pushing theory of object manipulation in macro world, and to improve the reliability and the precision of manipulation. [C290]

#### **"Process simulation of block copolymer lithography"**

Since the top-down approaches, such as the extremely ultraviolet (EUV) technique and the high-index fluid-based immersion ArF lithography, may be cover one or two generations, these lithography technologies are getting more severe for the feature size scaling down to sub-10-nm. The directed self-assembly technology of block copolymers is one of the candidates for next-generation lithography. The process simulation can help to solve the easy process, the low critical dimension (CD) variation, the high throughput, and the low number density of pattern defects for the directed self-assembly technology. In this paper, a directed self-assembly



lithography process of block copolymers is modeled and simulated in molecular scale. The sub-10-nm patterns can be formed by using the precise pattern placement of conventional "top-down" lithography methods with the well-defined nanostructures and self-healing properties of "bottom-up" block copolymer self-assembly. Simulation results are similar with experiment results by using a self-consistent field theory (SCFT). [C291]

### "Nanotechnology progress and future opportunities: 2000-2020"

Nanotechnology R&D has changed its focus, industrial relevance and governance since 2000 when was proposed in various national programs as a key science and technology development for 21st century. This presentation outlines the progress in foundational knowledge development, its current status supporting about \$80 billion production incorporating nanoscale components only in the United States, and likely evolution towards a general purpose technology by 2020. Nanotechnology has already powerful implications in knowledge foundation, advanced materials, catalysts, nanoelectronics, molecular medicine, energy conversion and storage. While general trends publications, patent publications, nanotechnology market and R&D funding continue to grow at an average annual rate of about 25%, the content of research and complexity of the new applications is changing significantly about 2010. In the next decade, the focus of R&D is expected to shift to direct measurements on three-dimensional domains, science based design of fundamentally new products based on complex nanosystems, and serving new areas of relevance such as quantum information systems. An increased focus will be on system nanotechnology as applied to sustainable resources including water, food, energy, materials and clean environment. [C292]

### "Multiscale modeling of nanoscale device fabrication"

Density function theory calculations provide the foundation for hierarchical modeling of the processes controlling fabrication of nanoscale devices. The roles of atomistic methods in nanotechnology modeling are described and examples of their application given. The resulting physical models provide both deeper insight into the processes controlling device fabrication, as well as tools for technology development and optimization. [C293]

### "Use of Carbon nanotubes in potential electronics packaging applications"

Packaging of electronics is an important technology to interconnect, power, cool and protect the components in highly integrated systems. Continuous size shrinking and function integration of future electronics are expected to be driven mainly by the advances in packaging technology. Carbon nanotubes (CNTs) are proposed for many novel packaging solutions thanks to their unique electrical, thermal, and mechanical properties. This paper introduces potential use of CNTs in electronics packaging, in both interconnection and thermal management applications. The challenges of fully exploiting the great potential of CNTs in this field are also discussed. [C294]

### "From the future technology perspective: challenges and opportunities"

In the future, the world will undergo a big transition due to aging society, growing global competition, and energy & environmental problems. The most influential factor to the future will be the paradigm shift of science and technology. The information technology has brought comfort and convenience to our daily life, and is expected to advance consistently by creating new services and technologies. In order for the future IT to continue to provide better services, it has to effortlessly overcome its limitations in the areas of existing technologies such as semiconductor, display, computing and network. In the future, there will be new business opportunities in the areas of eco-friendly energy, water, and air. Also, in the field of bio and health industry a new paradigm shift will occur towards predictive, preventive, personalized and participatory diagnosis and treatment. Nanotechnology is positioned at the center of innovation to accelerate inter-industry and intra-industry development by integrating information technology and biotechnology. [C295]

### "FemtoTera quantum optics: single cycles of light, single electrons and photons"

The physics of solid-state nanostructures is governed by the fact that materials properties change drastically when spatial dimensions are reaching the deBroglie wavelength of electrons. During the last decade, completely new functionalities have been achieved by exploiting these effects. On the other side, a comparable control in the fourth dimension, time, is still missing since it demands to manipulate optical transitions between quantum states on a few-femtosecond scale set by the oscillation period of light. This paper explores this fundamental regime of light-matter interaction. The experiments are based on recent advances of femtosecond technology such as ultrabroadband Ee: fiber lasers emitting single cycles of light, field-resolved detection of phase-locked electromagnetic transients with a bandwidth exceeding 100 THz and multi-terahertz sources delivering amplitudes in excess of 1 V/A which are comparable to inner-atomic fields. In this study on ultrafast nano-optics, a single semiconductor quantum dot was resonantly excited and coherently probed with a two-color femtosecond experiment. Full control over few-photon quantum statistics on molecular time scales is envisioned. To this end,



the coupling between solid-state based few-level systems and the light field has to be maximized. [C296]

### "Biosensing with photonic crystal surfaces"

Photonic crystals (PC) designed to produce narrow bandwidth resonant modes that extend into a surrounding fluid media have resulted in a variety of approaches for measuring the interaction of light with biological material. Label-free optical biosensing, PC-enhanced fluorescence (PCEF), PC-enhanced surface-enhanced Raman spectroscopy (PC-SERS), and distributed feedback laser biosensor technology have resulted from the ability to inexpensively produce large-area PC surfaces by methods that include nanoreplica molding in plastic and nanoimprint lithography on glass. This talk will summarize recent research in the Nano Sensors Group at the University of Illinois at Urbana-Champaign in which PC surfaces are used to address a variety of biosensing needs in pharmaceutical high throughput screening, disease diagnostic testing, gene expression analysis, chemical analysis, and point-of-care detection systems. Because PC surfaces can be produced upon inexpensive and flexible plastic substrates, they are inexpensively manufactured by roll-to-roll fabrication methods and incorporated into disposable microplates, cartridges, microscope slides, plastic tubing, and other labware. [C297]

### "Surface polariton scattering for charge transport and heat management in carbon-based heterogeneous electronics: Problem or solution?"

With increasing importance of non-Si electronics for the future generations of digital and analog devices the questions of ultimate performance limits and reliability of new electronic materials become critical. In the paper we review a particular case of heterogeneous carbon-based electronics. We assume that the nanotube material is combined with the materials of the standard Si-technology. Interface of the nanotubes or graphene with oxides presents, as we demonstrate below, a significant source of inelastic surface scattering. Hot electrons release the energy by emitting surface polaritons with the scattering rate of the order of ten fs. Such a fast mechanism, dominating scattering in the heterogeneous electronics devices, should determine (i) low-field mobility at room temperature, (ii) saturation currents in the high-power regime and (iii) thermal coupling to the substrate, discussed here in details. Such thermal coupling is explained below in terms of large QED Kapitza conductance. Good thermal properties of carbon hetero-interfaces with Si and high-k oxides are promising for efficient heat dissipation and thermal management. [C298]

### "Robotic manipulation and control for Micro and Nano mechatronics"

Mechatronics was born in Japan in 1969. It is the synergetic integration of the Mechanical engineering and Electronic engineering with computer technology. It is a design discipline for the system integration for the structure and control of the target system. Today's mechatronics has advanced more and more to wider and broader areas, such as Micro and Nano mechatronics. In this lecture, this field is overviewed from the standpoint of robotic manipulation and control. Micro mechatronics is one of Mechatronics areas and has made remarkable progress recently, such as micro sensor and actuator for automotive technology, avionics technology, bio-medical manipulation technology, consumer electronics, and many others. It is mainly based on the Silicon lithography technology and other micro-fabrication technologies. Micro TAS (Total Analysis System) is one of the Micro technological applications. Nano mechatronics deals with the much smaller sized world than the Micro mechatronics. Nanotechnology gives technologies for nano-fabrication, nano-instrumentation and nano assembly for these areas, including nano-sensor, actuator and manipulation technology. Bio nanotechnology based on the Nano-mechatronics is also promising for the research in life-science. Thus the micro and nano robotic manipulation and control will play an important role for the 3 dimensional fabrication and assembly system and those application examples will be shown in this lecture. [C299]

### "Lab-on-a-Chip Technology for Integrative Bioengineering"

Recent progress of lab-on-a-chip technology is challenging for the development of nanobiotechnology and integrative bioengineering. In this work, several novel microfluidic devices for biotechnology and bioengineering, based on the synergetic integration of miniaturization technology to biology, chemistry, and medicine, are described. Currently, we focus on the development of a nanobiosensor, microfluidic device and lab-on-a-chip as a new platform for biological sample processing, separation, and detection, including optoelectrofluidic manipulation, hydrophoretic separation, magnetophoretic assay, and cell-based assay. The final application of these research activities covers several aspects of biomolecular diagnostics, micro total analysis system ( $\mu$ TAS), cell-based screening platform, nanobio device, etc. [C300]

### "Nanotechnology commercialization: World and Korean trends and their perspectives"

Recently, nanotechnology (NT) commercialization is becoming increasingly emphasized. In this paper, we review



the world and Korean trends of NT commercializations. Many products using the so-called classical benefits of NT which exploit the characteristics of the increased surface-to-volume ratio and the reduced mass of the particles can be found in the market. But the quantum and self-organizing properties peculiar to NT are observed to be still far away from being fully exploited at the industrial level. The necessities of advanced old industries to fully benefit the enabling technology characteristics of NTs are also discussed taking the Korean nanodevice industries and nanomedical technologies as an example. This survey leads us to conclude that the commercial sector of Korean NTs shows more innovative characteristics rather than disruptive ones. It is also argued that the market size of energy-related NT and nanomedicine sub-areas has a great potential to grow in near future. However, insufficient basic researches for the hierarchical assembly of complicated nanostructures and functionalities, and the need of large investments for their commercializations as well as the public reluctance to accept nano-products will be the main obstacles to the NT commercialization. [C301]

#### **"Socio-ethical issues and nanotechnology development: Perspectives from India"**

Ethical issues arise when the technology is developed with inadequate information about right/wrong outcomes and the costs for future generations.. In the context of nanotechnology in developing countries a range of socio-ethical issues pertaining to-benefits vs. risks, equity and access to technology, public engagement and democratic participation, the need for involvement of various stakeholders from developing countries-needs to be addressed. This paper explores socio-ethical issues associated with nanotechnology development in India. First, it provides nanotechnology in India by describing investment climate, priority areas, institutions and issues. Second, reflections on socio-ethical issues in nanotechnology are drawn from a survey across various scientific institutions of India. Third, it addresses the relevance of the precautionary principle in practice for the regulation of nanotechnology in India. Fourth, it examines how the public should be engaged in cooperation with government and industry and finally makes suggestions of how to go about responsible nanotechnology governance in India. [C302]

#### **"Real-time monitoring of nanoparticles at a metal nanopowder manufacturing workplace"**

In nanomaterial manufacturing workplaces, there is a potential risk due to nanomaterial exposure to workers. To investigate this possibility, the number concentration and the size distribution of nanoparticles were continuously monitored using an ultrafine condensation particle counter and a scanning mobility particle sizer, respectively at a metal nanopowder manufacturing workplace during the wire electrical explosion process. From this field study, nanoparticles smaller than 30 nm in diameter were dominantly observed. One event showing high particle number concentration that was approximately seven times higher than background level was also detected for a short period. Therefore, it is recommended to install a reduction measure for safe workplace environment. [C303]

#### **"Code of conduct for nanotechnology researchers"**

For the sound developments of emerging technologies like nanotechnology, it is important to establish proper societal and cultural environments. Considering the information gap regarding the safety of nanoparticles, a specific code of conduct for researchers and efficient efforts in communication with the public are required... In this paper, the lack of solid evidences concerning toxicological properties of nanomaterials in human health and environmental safety is pointed out and necessary items for code of conducts for responsible research are considered. [C304]

#### **"Manufacturing of micro gas bearing for power MEMS applications using nanopowder metallurgy processing"**

This paper introduces manufacturing of tilting pad gas bearing with a diameter of 5 mm and a length of 0.5~1mm for power MEMS (Micro Electromechanical Systems) applications. Potential applications include micro gas turbines (100W) for mobile robots, turbo compressors/micro blower for micro fuel cells, micro bearings for pediatric heart, etc. Ultra fine gas bearing for micro component is so complicated that it is hard to fabricate by conventional machining from a manufacturing point of view. In the field of a manufacturing technology for micro parts, nanopowder processing has received a great deal of attention in recent years. In this study, the nanopowder tilting pad gas bearings were prepared by two different methods using: Ni-metal mold by LIGA process, and PDMS soft mold. The effect of the manufacturing condition on sintering properties of metal-nanopowder gas bearing was investigated. The density, shrinkage behavior and dimensional stabilities were analyzed, and the reproducibility was discussed in the compaction and sintering step. [C305]

#### **"Development of technology to pulverize natural plant material into d97 3 µm size of powder using air classifier mill"**



This study was done to develop a pilot equipment, which can pulverize and classify ginseng into 3  $\mu\text{m}$  size of powder, and in which R-22 cooling system is installed to preserve pharmacological compounds and make plant materials brittle. Pulverizing mechanism, in which rotor and stator can destroy the cell wall of plant materials effectively by high shear, and classification mechanism, which uses centrifugal force and drag force produced by the high speed rotation of rotor, were developed. The pilot equipment was tested with ginseng. When Stokes range was  $\leq 0.3$ , and the radius of cut size was 40.0  $\mu\text{m}$ , the 3  $\mu\text{m}$  size of powder can be produced economically. Therefore, the results can be applied in scaling up the pilot equipment into an equipment for mass production. [C306]

#### "SiO<sub>2</sub>/Si<sub>3</sub>N<sub>4</sub> bilayer sloped etching for 20nm InAlAs/InGaAs metamorphic HEMTs"

We developed a 20 nm gate process using SiO<sub>2</sub>/Si<sub>3</sub>N<sub>4</sub> bilayer sloped etching. Selective and sloped etching of bilayer makes this technology realizable. A HEMT with this technology has merits of fine length definition beyond the limit of electron beam (E-beam) lithography system. Using this technology, we experimentally demonstrated that a 20 nm gate length from initial 50 nm line pattern. The fabricated InAlAs/InGaAs metamorphic HEMTs (MHEMTs) with 20 nm T-gate pattern have high DC and RF performance characteristics, a transconductance of 1.67 S/mm, a cutoff frequency  $f_t$  of 460 GHz. [C307]

#### "Low-power and highly reliable logic gates transistor-level optimizations"

Power dissipation and reliability are two major challenges when designing gates and circuits using nanoscale devices. This paper proposes a novel approach for the design of CMOS logic gates which aims to simultaneously decrease their power consumption and their probabilities of failure. This new sizing method was evaluated on CMOS inverters and NOR-2 gates at three technology nodes: 16nm, 22nm, and 32nm. The new inverters and NOR-2 were compared to the classic gates. The results show that the new gates have significantly lower power and higher reliability when compared to classic CMOS gates. The results also suggest that the advantages of the new design method are enhanced at smaller feature sizes: at 16nm the new gates outperform the classic ones in reliability, power, and PDP. [C308]

#### "Keynote speech I: Fluctuation control for plasma nanotechnologies"

Recent progress in nano-materials has made them attractive for an increasing number of their applications such as electronics, medical components, fillers, catalysts, and fuel cells. Nanomaterials need structures and components which exhibit novel and significantly improved physical, chemical and biological properties, because of their nanoscale size, and hence fabrication of nanomaterials by bottom-up processes as well as that by top-down ones are required. A wide variety of nano-material and nano-system fabrication methods are required to be developed to realize complex nano-world. Plasma-based fabrication of nanomaterials and nanostructures is widely employed for top-down processes such as ULSI fabrication as well as bottom-up processes such as carbon nanotube production. We are exploring frontier science of interactions between plasmas and nano-interfaces by focusing on novel features such as fluctuations of interactions due to the nanometer scale. Plasma processing based on the science realizes highly precise top-down processes by suppressing fluctuations and well controlled self-organized bottom-up processes by controlling fluctuations. We aim to bring about an explosive development of fabrication technologies of nanomaterials and nanostructures. [C309]

#### "Nonlinear dielectric properties of NaNO<sub>2</sub> in silicate matrices MCM-41"

The properties of NaNO<sub>2</sub> in the restricted geometry were studied by nonlinear dielectric spectroscopy. It is shown that for silicate matrices MCM-41 filled with NaNO<sub>2</sub>, reducing the pore size leads to an increase in the nonlinearity and the change in the shape of the temperature dependence of the amplitude of the third harmonic. [C310]

#### "Heat spreader technology for silicon chip"

After the introduction of the Pentium™ processor in 1993, the trend of the processor performance and power consumption have been increased significantly each year. Heat dissipation has been increased but in contrast the size of die on the processor has been reduced or kept the same due to nano-size circuit technology, thus making the heat flux critically high. The heat flux was about 10-15 W/cm<sup>2</sup> in the year 2000 and had reached 100 W/cm<sup>2</sup> in 2006. For effective cooling, the least temperature gradient between the heat source and radiating components is required. There is a limit to solve thermal issue only by heat-sink improvement in this case, because of size limitation. Minimizing thermal resistance of CPU package itself is required. Thermal interface between silicon die and heat spreader has changed from thermal grease to phase-change-material (i.e. PCM). Recently, some model use indium as thermal interface. Meanwhile heat spreader design doesn't change much. The best-known device for effective heat transfer or heat spreading with the lowest thermal resistance are heat



pipe and vapor chambers, which are two-phase heat transfer devices with excellent heat spreading and heat transfer characteristics. In this paper, newly designed vapor chamber is proposed to spread heat from CPU to the heat sink. This newly proposed vapor chamber consists of micro channel wick structure instead of the traditional sintered powder wick. In traditional vapor chamber, often ballooning problem occurs. However in the case of micro channel vapor chamber this problem can be improved. [C311]

### **"Challenges of patterned media"**

Hard disk drive industry has been looking at a successor for the granular perpendicular recording media technology for more than 5 years. Patterned media technology, in the form of discrete tracks and subsequently in discrete bits, was believed to be one of the potential candidates. However, the interest in patterned media has been declining because of certain challenges. This paper discusses the technological and economical challenges associated with patterned media and some potential solutions. [C312]

### **"Control of self-organization microporous honeycomb film by the irradiation of nano second laser pulse: Deliberation of heat affected and shock wave by laser irradiation"**

We present a controlling technique of microporous structure by laser irradiation during self-organization process. Polymer solution was dropped on the substrate at high humid condition and the honeycomb structure of regularly aligned pores on the film was fabricated by attaching of water droplets on the solution surface. We demonstrated that it was possible to prevent forming of pores at the region of laser irradiation and flat surface was fabricated. We also demonstrated that a combination structure with two sizes pores by laser irradiation. Our method is a unique microfabrication processing technique that combines the advantages of bottom up and top down techniques. This method is expected that application for photonic crystals, biological cell culturing, surface science and electronics fields, etc. [C313]

### **"Coordinate measurement of micro groove on MEMS device by optically controlled microprobe"**

Recently, ultra-high accuracy coordinate measuring machine (Nano-CMM) is demanded for inspecting 3D shapes of micro components. The most important element to achieve the Nano-CMM is the probe for sensing surfaces of 3D components. In this study, laser trapping probe, which is the micro-sphere trapped in air by optical radiation pressures, is proposed as a novel probe. In this paper, micro-groove structure on micro electromechanical system (MEMS) device is measured by using laser trapping probe with circular motion, which is improved to have same sensing property by use of the element of radial polarization. The probe has a diameter of 8  $\mu\text{m}$  while conventional micro probes have a diameter of several tens of  $\mu\text{m}$ . The small probe makes it possible to measure narrow space of 50  $\mu\text{m}$ . Moreover, the probe enables to measure specimen regardless of the approaching direction. This shows the potential that laser trapping probe enables to measure any micro structure with same manner. Although there are some conjectures to resolve, it seems that the laser trapping probe is validity as a probe for Nano-CMM. [C314]

### **"Manipulation of droplet and crystal growth by Paul effect"**

Crystal growth in the microgravity is attracting attention for material science because it is possible to produce a uniform crystal. A purpose of this research is to manipulate a small droplet with a diameter of nano-micro meters by Paul effect and to vaporize for producing a crystal. In case a cylindrical electrode between cap-electrodes is charged, a micro particle of whatever solid, liquid and solution is manipulated a simple harmonic motion behavior. An electrical charge of trapped particles is derived from analyzing a motion of vibration particles using high-speed camera. Applied voltage and frequency are adjusted to control a position of the particle. Finally, we succeed to fabricate crystals of sodium and KDP. [C315]

### **"Nano-fabrication dependent quality factor in photonic crystal slab biosensors"**

Photonic crystal slabs (PCS) are attractive for label-free optical bio-sensors inside micro-fluidic portable diagnostic systems due to their high sensitivity and easy coupling to external radiation. Obtaining high quality factor (Q) values for the guided resonances in these index-of-refraction PCS biosensors is crucial for high sensitivity. Non-ideal fabrication of the hole array in the PCS due to electron beam writing, pattern transfer, and reactive ion etching (RIE) steps will result in imperfect circular hole shapes, and non vertical hole profile that can reduce the Q values. We evaluate the effect of nano-fabrication on the quality factor of guided resonances in PCS biosensors and investigate the potential limitations on sensitivity with current fabrication technologies in a realistic PCS biosensor due to fabrication errors. Spectral broadening of the guided resonances (lower Q values) is found for the fundamental guided resonance modes but no significant changes were observed in higher order guided resonances. These findings are consistent with reduced bio-sensing sensitivity in higher order modes due to reduced field overlap with the analyte in side the micro-fluidic channels. [C316]



### "Social impact of in-vitro endovascular surgery simulation technology"

Silicone vasculature phantoms built relying on medical imaging data and computer assisted designed were presented in 2005 as an in-vitro simulation environment for endovascular surgery simulation. Due to the realistic recreation of human vasculature morphology and mechanical characteristics, several simulation techniques were created relying on that modeling technology to satisfy different simulation needs. Among those new simulation technologies there are modeling techniques, force sensing methods for intravascular tools, flow control systems for human pressure simulation, Interventional Radiology Environment simulation and image processing for quantitative description of catheter trajectory. A poll was done in a population of health care specialist, industry and engineering to find their simulation needs. As results their principal needs are the visualization and quantification of the interaction between the endovascular tools and the vasculature phantoms. [C317]

### "Nanoprobe insertion for nanoinjection based on E-SEM nanorobotic manipulation"

This paper presents a nanoprobe insertion for nanoinjection applications for biological species based on environmental-scanning electron microscope (E-SEM) nanorobotic manipulation system. Based on the bio-nano manipulation system, we have been proposed a nano-injection method by nanoprobe insertion. The nanoprobe is designed to have a sharp tip to insert the probe into biological specimen. It is fabricated by focused ion beam (FIB) process. The nano-scale size is important for minimal damage and enough rigidity to biological specimen. A *Caenorhabditis elegans* (*C. elegans*) is used as a target biological specimen, which is one of the important model organism for diseases analysis. The direct nanoinjection technique into a biological organism is needed to transport fluorescent materials or specific biological proteins into its specific cell as in-vivo experiment. The proposed system is considered to be important as future nano-surgery system for life innovation using model organism. [C318]

### "Fabrication and evaluation of nano probe pH sensor based on nanorobotic manipulation"

This paper presets the assembly of a nanowire probe pH sensor and evaluation inside acid and alkali. An AFM cantilever was used for electrodes of the device and etched by FIB. Two carbon nanotubes (CNT) were assembled to the separated electrodes of AFM cantilever. A tungsten probe is etched by focused ion beam (FIB) into 300 nm in diameter and 25 in length. Then the probe is coated by parylene and cut the tip to open the tungsten. A tungsten nanowire is used for work electrode and a platinum nanowire is used for counter electrode. The nanowires were fabricated via field emission method by introducing hexacabonyl tungsten and trimethyl cyclopentadienyl platinum individually inside a field emission electron microscope. The nano probe pH sensor is tested inside acid and alkali buffer solution with different response. [C319]

### "Study of nano-regime strained MOSFETs with temperature effects"

Strained engineering in nano process technology is considered to be a promising enhancements on the electric characteristics of MOSFET devices. Both tensile and compressive strains are applied to NMOS and PMOS individually using silicon nitride as contact etching stop layer (CESL). As appeared in this study, the electrical characteristics are to be compared with or without strain on 10 $\mu$ m/10 $\mu$ m (channel length/ width) at various temperatures, and more benefits of compressive CESL and tensile CESL for NMOS and PMOS, respectively, are seen. One thus goes on to check with the trans-conductance (gm) and the leakage current. The data that were shown assure us the next-generation promising devices. [C320]

### "Nano knife fabrication and calibration for single cell cutting inside environmental SEM"

The current techniques for cell cutting always use a diamond knife with an edge angle larger than 20°. The compression caused by the edge angle may destroy the sample. In this paper, a nano knife with a small edge angle 5° was fabricated from a commercial AFM cantilever by FIB etching. The mechanical character of the nano knife was calibrated by theoretical calculation, numerical simulation and nanorobotic manipulation methods respectively. Single cell cutting was performed by using the nanorobotic manipulation system inside an Environment-SEM. The maximum cutting force was calculated based on the deformation of the nano knife beam. The calibration and experimental result showed the nano knife was capable for cell cutting task. The angle between two cell slices after cutting was around 15°, which means the compression force caused by the knife edge angle can be reduced. [C321]

### "Silicon integrated electronic-photonic ICs"

Copper interconnect is unlikely to be the ultimate solution to support the growing functionalities of next generation microprocessor due to its information latency and power consumption. Converging EPIC on a single



chip platform to enable functional diversification emerges as one promising approach to be realized by taking the advantage of low energy and huge data capacity of optical interconnects. In this presentation, we present an overview on the current status of this critical technology development and provide an outlook and strategies for the integration of Si micro- and nano-photonics to meet the bandwidth and energy requirements of data communication in future technology nodes. [C322]

### "Thermal modeling of nanodevices"

In this paper we summarize 6 years of work on modeling self-heating effects in nano-scale devices at Arizona State University (ASU). We first describe the key features of the electro-thermal Monte Carlo device simulator (the two-dimensional and the three-dimensional version of the tool) and then we present series of representative simulation results that clearly illustrate the importance of self-heating in larger nanoscale devices made in silicon on insulator technology (SOI). Our simulation results also show that in the smallest devices considered the heat is in the contacts, not in the active channel region of the device. Therefore, integrated circuits get hotter due to larger density of devices but the device performance is only slightly degraded at the smallest device size. This is because of two factors: pronounced velocity overshoot effect and smaller thermal resistance of the buried oxide layer. Efficient removal of heat from the metal contacts is still an unsolved problem and can lead to a variety of non-desirable effects, including electromigration. We propose ways how heat can be effectively removed from the device by using silicon on diamond and silicon on AlN technologies. [C323]

### "Positioning loads within the nanometer scale the mechatronic way to do it"

The semiconductor- and the new growing up micro and nano manufacturing industry needs more and more precise drive systems with a high accuracy positioning behavior for their production. For example to inspect wafers of the new 32/28 nm Clarkdale and Arandale Chip series from Intel, wafer inspection systems are required which stabilizes the moved wafer within a 3-dimensional cube of 10nm. The new 22/20 nm processor technology, where the volume production will start in 2012-2013, will increase the demands of such systems once more to stabilize within a cube of 5 to 6 nm. To fulfill the demands of such processes concerning the desired accuracy, the whole mechatronic chain of a drive system must be considered carefully. This talk will focus on the actual research and on the design of high accuracy positioning drives which are able to position loads within the nanometer scale. Linear motors, voice coils, piezo's and the "new" types of actuators are considered to drive such systems. The special needs regarding the amplifiers and the linear bearings such as air cushions are highlighted. Different controller concepts will be discussed and compared together. The presented examples include an inspection system for wafer inspection, a laser focusing system as well as a laser wave length stabilizing system. [C324]

### "Quality monitoring of laser welding"

In this paper, a study of quality monitoring technology for the laser welding was conducted. The laser welding and the industrial robotic systems were used with robot-based laser welding systems. Over the past years, Trumpf's 4kW Nd:YAG laser (HL4006D) and ABB's IRB6400R robot system (payload:120kg) were used. The new laser source, robot and laser scanner system are used to increase the processing speed and to improve the efficiency of processes. The laser system used in this study was IPG's 1.6kW Fiber laser (YLR-1600), while the robot system was Hyundai Heavy Industry's HX130-02 (payload: 130kg). The robot-based laser welding system was equipped with a laser scanner system for remote laser welding. The welding joints of steel plate and steel plate coated with zinc were butt and lapped joints. The quality testing of the laser welding was conducted by observing the shape of the beads on the plate and the cross-section of the welded parts, analyzing the results of mechanical tension test, and monitoring the plasma intensity by using UV and IR sensor. This paper proposes the quality monitoring method and the robot-based remote laser welding system as a means of resolving the limited welding speed and accuracy of conventional laser welding systems. [C325]

### "Recent advances in high-throughput scanning-probe technology"

Widespread deployment of scanning-probe techniques in applications such as semiconductor metrology, lithography and data storage requires significant improvements in throughput, achievable resolution and probe and media reliability. One way to improve the throughput and reliability of probe-based devices is to employ an array of probes. However, for parallel operation of several cantilevers, integrated sensing and actuation are essential. Thermo-electric sensors and magneto-resistive sensors are excellent candidates for integrated sensing. Moreover, there is a need for improvements in nontopographical sensing schemes, such as electrical sensing. Finally, nanopositioning is another key enabling technology to achieve very high bandwidth and hence high throughput. Position sensor noise is detrimental to achieving nanoscale resolution at high bandwidth, and several techniques exist to mitigate the effect of sensing noise. Recently developed small-amplitude dynamic-



mode techniques are also excellent for array operations owing to their simplicity of implementation. In this paper, we review recent key advances in high-throughput scanning-probe technology. [C326]

### "Non-Volatile semiconductor memories for nano-scale technology"

In this paper we will review the evolution of Non-Volatile Memories (NVM) through the last decades, driven by a continuous introduction of new materials that helped the reduction of the single cell area and so the cost of the memory. As we entered into the sub-20 nm realm, limitations are appearing for Flash memories and alternative physical mechanisms are proposed to store information in high density media. In this scenario, Phase Change Memory (PCM) is demonstrating the capability to enter the broad memory market and to become a mainstream technology. [C327]

### "Nanowire-based 2-D and 3-D XoY electronics"

The authors discuss the 3-D and 2-D X-on-Y (XoY) assembly techniques, utilizing specific examples to illustrate the potential of these methods for the fabrication of high performance devices on arbitrary substrates. For fabrication of 3-D structures, a templated nanomaterial growth technique is used. Specifically, anodic aluminum oxide (AAO) is used as the growth template. Alternatively, for 2-D assembly, a nanomaterial transfer process is used, where the nanostructures are first grown on a convenient growth substrate, and then deterministically placed on a substrate of choice using photolithography in conjunction with a printing process. 2-D and 3-D XoY assembly and integration of nanostructured materials are demonstrated for electronics, sensing, and energy applications. The presented devices illustrate the versatility and potential of XoY techniques for the fabrication of a large array of high performance devices on flexible and low-cost substrates. [C328]

### "Metal optics, optical antennas, and spontaneous hyper-emission"

For almost 50 years, stimulated emission has been stronger and far more important than spontaneous emission. Indeed spontaneous emission has been looked down upon, as a weak effect. Now a new science of enhanced spontaneous emission is emerging, that will make spontaneous emission faster than any possible stimulated emission. This new science depends upon the use of nanoscale metallic optical elements, as antennas for spontaneous emission. The overall increase in spontaneous emission rate can be roughly 8 orders of magnitude! Under favorable circumstances the spontaneous emission rate can be comparable to the optical frequency itself, which is unprecedented. Among the applications will be: (1) Direct modulation of LED's will extend above 1THz, far faster than the direct modulation speed of any laser. This may define the future of short distance data-communications technology. (2) Materials which do not fluoresce or luminesce, owing to strong non-radiative losses (i.e. most molecules), will now become spectroscopically accessible since their spontaneous emission will now compete favorably with non-radiative losses. This is expected to have revolutionary implications in basic biological research, since a local probe can be inserted into a cell to optically interrogate the molecules at the tip. The lecture will provide the basic background in metal optics, and in optical frequency antennas required to understand the photo-physics of this new form of light emission. [C329]

### "Development of sub-100 $\mu$ W microwave RTD VCOs"

An extremely low dc power RTD VCO IC is demonstrated by utilizing a single-mode topology. The single-mode RTD VCO is implemented using a scaled down RTD with an emitter size of  $0.7 \times 0.7 \mu\text{m}^2$ . The fabricated single-mode RTD VCO shows the extremely low dc power consumption of 59  $\mu$ W in the core part at 12.2 GHz. To the authors' best knowledge, the obtained core dc power consumption is the lowest reported up to date in the Ku band. In addition, the second harmonic balanced RTD VCO is also fabricated in the same MMIC technology to reduce the total dc power consumption based on a push-push principle. The fabricated second harmonic RTD VCO shows the total dc power consumption of sub-100  $\mu$ W in the Ka band. [C330]

### "Reversible logic based concurrent error detection methodology for emerging nanocircuits"

Reversible logic has promising applications in emerging nanotechnologies, such as quantum computing, quantum dot cellular automata and optical computing, etc. Faults in reversible logic circuits that result in multi-bit error at the outputs are very tough to detect, and thus in literature, researchers have only addressed the problem of online testing of faults that result single-bit error at the outputs based on parity preserving logic. In this work, we propose a methodology for the concurrent error detection in reversible logic circuits to detect faults that can result in multi-bit error at the outputs. The methodology is based on the inverse property of reversible logic and is termed as 'inverse and compare' method. By using the inverse property of reversible logic, all the inputs can be regenerated at the outputs. Thus, by comparing the original inputs with the regenerated inputs, the faults in reversible circuits can be detected. Minimizing the garbage outputs is one of the main goals in reversible logic design and synthesis. We show that the proposed methodology results in 'garbageless' reversible circuits. A



design of reversible full adder that can be concurrently tested for multi-bit error at the outputs is illustrated as the application of the proposed scheme. Finally, we showed the application of the proposed scheme of concurrent error detection towards fault detection in quantum dot cellular automata (QCA) emerging nanotechnology. [C331]

#### "Montgomery modular multiplier design in quantum-dot cellular automata using cut-set retiming"

Quantum-dot cellular automata (QCA) technology is a promising alternative to CMOS technology. QCA provides a novel paradigm both for communication and computation. Meanwhile, a new challenge referred to as the "layout = timing" problem is introduced due to the unique clocking and inherent pipeline nature of "wires" in QCA. As a result, feedback is intractable in sequential circuits due to the QCA timing constraints. Cut-set retiming is a technique to solve the timing issues. It can accommodate the QCA characteristics by performing delay-transfer and timing-scaling to relocate the existing delays. Cut-set retiming makes it possible to effectively design more complicated QCA circuits. In this case study, a QCA Montgomery modular multiplier is designed, which is the first application of cut-set retiming to QCA circuit design. [C332]

#### "Implementation of a 4:1 multiplexing quantum-effect IC based on RTD circuit topology"

A quantum-effect 4:1 multiplexing IC using Resonant Tunneling Diodes is proposed and fabricated. The new proposed IC has been designed based on the power-efficient NDR (negative differential resistance) topology of four CML-MOBILEs, which has the features of low-power and high speed by means of the unique NDR characteristics of the RTD. The 4:1 multiplexing operation of the proposed circuit is confirmed by implementing the circuit using an InP MMIC technology. The fabricated IC has operated up to 30 Gb/s with a low dc-power consumption of 87 mW for a supply voltage of -3.3 V. This result shows the first demonstration of the low-power high-speed 4:1 multiplexing IC based on the quantum-effect device technology. [C333]

#### "A new SAW device with tellurium sensing film for NO<sub>2</sub> detection"

A new surface acoustic wave device is demonstrated using tellurium (Te) sensing film on ST-X quartz substrate to detect NO<sub>2</sub> dynamically at room temperature. The real-time frequency shift as a function of NO<sub>2</sub> gas concentration is collected by Universal Counter. Devices with three different Te thicknesses of 60, 120 and 180 nm have been compared. It is found that the device with 120 nm Te film has the largest frequency shift, the device with 180 nm Te film follows and the device with 60 nm Te film shows the smallest frequency shift. [C334]

#### "Integration of plasmonic antenna on quantum cascade laser facets for chip-scale molecular sensing"

Many important bio-molecules, such as proteins and pharmaceuticals, have their natural resonances in the mid-infrared (2–30  $\mu\text{m}$ ) region of the optical spectrum. The primary challenge of sensing these molecules is to increase the interaction between them and light with such long wavelengths. This can be overcome by exploiting optical nano-antennas which can squeeze the optical mode into a volume much smaller than the operating wavelength. We present a novel antenna design based on hybrid materials composed of a coupled Au-SiO<sub>2</sub>-Au nanorod integrated on the facet of a quantum cascade laser (QCL) operating in the mid-infrared region of the optical spectrum. FDTD simulations showed that for sandwiched dielectric thicknesses within the range of 20 to 30 nm, peak optical intensity at the top of the antenna ends is 4000 times greater than the incident field intensity. The device was fabricated using focused ion beam milling. Apertureless mid-infrared near field optical microscopy (NSOM) showed that the device can generate a spatially confined spot within a nanometric size about 12 times smaller than the operating wavelength. Such high intensity, hot spot locations can be exploited to enhance the photon interaction for bio-molecules for sensing applications. [C335]

#### "A robust and sensitive silicon tactile imager with individually formed SU-8 protective layers on piezoresistor pixels"

In this paper, a new structure of silicon tactile imager with SU-8 protective layer is presented. The protective layer is formed on the surface of integrated piezoresistor array to prevent direct contact of the sensor surface to the object. The protective layer is formed individually on each pixel circuit to prevent degradation of the spatial resolution. This tactile imager is fabricated by an established post-CMOS process without any process damage to the MOS integrated circuits. The independent protective layer is simply formed by a single step of SU-8 lithography on the pixel array. The experimental device fabricated in this study integrates a 5  $\times$  5 array of piezoresistors on a silicon 10  $\mu\text{m}$ -thick diaphragm fabricated by an SOI active layer. The scale of integration and the pitch of the piezoresistor pixel array (800  $\mu\text{m}$ ) are determined by the feature size of circuit fabrication technology and the minimum resolution of the SU-8 lithography process. In the fabricated device, both high sensitivity and spatial resolution are obtained by the new structure with high robustness. [C336]



### "Performance enhancement of organic solar cells using plasmonic effects"

We have investigated an analytic model that describes the light absorption and carrier transport in bulk heterojunction organic solar cells based on poly (3-hexylthiophene): (6, 6)-phenyl-C61-butyric-acid-methyl ester (P3HT:PCBM) blend. In order to calculate the power conversion efficiency (PCE) the current-voltage characteristics is analyzed and plotted by varying the active layer thickness, a device with higher PCE is obtained. We inserted the metal nanoparticles (MNPs) inside the active layer and studied the device structure using Finite Difference Time Domain (FDTD) method. Considering the proposed model, we observed that, the absorption coefficient and PCF are increased considerably. [C337]

### "Copyrite"

The following topics are dealt with: high performance gyroscope technology; nano biosensors; opto-chemical sensors; remote powering for biomedical implants; silicon photosensors; sensors for human condition monitoring; sensor/actuator system; chemical and gas sensors; optical sensors; rotation and vibration sensing; graphene based sensors; wireless sensor networks; electrochemical and PH sensors; sensor for control of mobile platforms; resonant and inertial sensors; active sensing and chemosensory optimization; remote sensing and circuits; optical fiber sensors; energy harvesting; accelerometers; sensing in blood; chemiresistive sensors; green RFID and RFID-enabled wireless sensors; multi-spectral systems; mechanical and physical sensors; force sensing applications; resonators; sensor network algorithm; piezoresistive materials and fundamentals; sensing of cells; sensors based on metamaterials; piezoelectric MEMS sensors; biomimetics; nanofabrication nanosensing; pressure sensors; strain sensors and structural monitoring; neuro-sensors; thermal sensing; IR and magnetic sensing; acoustic and optical sensing systems; preconcentrators and thermal flow systems; NEMS/MEMS material properties; stress sensing; tactile and tissue sensing; and integrated sensors and signal conditioning. [C338]

### "Towards automated handling of biomaterials for nano-biosensor fabrication"

The integration of biomaterials into micro-systems or sensors can improve the properties of such systems or even lead to the development of novel innovative systems. A key problem is the development and realization of handling and manipulation methods as enabling technology for their micro-nano-integration. In this paper, novel methods for the manipulation and handling of DNA to design nanoelectric parts and to solve packaging issues at the nanoscale are presented. Concerning DNA handling, first results of a movement for the fine tuning of the DNA position and for movement of complete strands are presented. Furthermore, an AFM-based technique for the structuring of biosensor biocomponents (e.g. antibody-antigene assays) for automated and mobile diagnostic systems usable in medicine and research is presented. For the optimization of methods to handle long nanoscopic objects, the current state of our research to develop the new lateral vibration AFM mode is presented. [C339]

### "Positioning control for Piezo scanner using multirate perfect inverse model based iterative learning control"

Recently, in high precision positioning field, the improvement of the positioning accuracy is required for the development of the next generation technology like nano-technology. In many industry application machines, we can often see the repetitive operation [?]. For the repetitive position command of the positioning machine, the investigation for the suppression of the repetitive tracking error using iterative learning control (ILC) is increasing. For above reasons, the purpose of this paper is improvement of the positioning accuracy in the high-speed repetitive position command. The plant is the Piezo-scanner of the atomic force microscope which is not only used for measurement device but nano-manipulation. the requirement of positioning accuracy of the AFM is nano-scale. In ILC, the inverse system of the plant is often used as the learning filter. This design of the learning filter using the inverse system is most important part in ILC system design. Thus, there are many methods of the inverse system design. In this paper, the ILC using the perfect inverse system of the plant which based on the perfect tracking control is proposed. Its proposed inverse system of the plant is the perfect inverse system of the plant, and the all poles of the proposed inverse system of the plant can be located on the origin in discrete-time domain. Thus, the proposed inverse plant has good characteristics for ILC system. In this paper, the effectiveness of the proposed method is shown by the some simulations and experimental results. [C340]

### "Variation-Aware Fault Modeling"

To achieve a high product quality for nano-scale systems both realistic defect mechanisms and process variations must be taken into account. While existing approaches for variation-aware digital testing either restrict themselves to special classes of defects or assume given probability distributions to model variabilities, the



proposed approach combines defect-oriented testing with statistical library characterization. It uses Monte Carlo simulations at electrical level to extract delay distributions of cells in the presence of defects and for the defect-free case. This allows distinguishing the effects of process variations on the cell delay from defect-induced cell delays under process variations. To provide a suitable interface for test algorithms at higher levels of abstraction the distributions are represented as histograms and stored in a histogram data base (HDB). Thus, the computationally expensive defect analysis needs to be performed only once as a preprocessing step for library characterization, and statistical test algorithms do not require any low level information beyond the HDB. The generation of the HDB is demonstrated for primitive cells in 45nm technology. [C341]

#### "Ultra-low-Power Ultra-fast Hybrid CNEMS-CMOS FPGA"

Energy efficiency and idle power consumption are becoming important parameters in the design of embedded systems that are realized with nanometer-scale CMOS devices. In nanometer-scale CMOS, Excessive quiescent power dissipation can lead to excessive heat generation and reliability issues. To address energy efficiency and idle power consumption, we present a novel Complementary Nano-Electro-Mechanical (CNEM) switch that we manufactured which operates with virtually zero leakage current, has 1 to 2 Volts operation voltage, > 1 GHz fundamental resonant frequency, and nanometer-scale footprint. These CNEM switches can be "dropped" in and hybridized with CMOS at the metallization or device levels to manage leakage current and power. In this paper, we present a hybrid CMOS/CNEMS FPGA. The hybrid FPGA is based on using the CNEM switching device as a replacement of CMOS devices in the switch and connection block components found in FPGA architectures. We analyzed the impact of the CNEM substitution on power and delay using VPR and the MCNC benchmark circuits. We present experimental results showing an average 98%, 85%, 71%, and 99.99% reduction in critical path delay, routing energy, total energy, leakage power when comparisons are made between FPGA design using pure CMOS (180nm technology and hybrid CNEMS and CMOS (180nm) technology. [C342]

#### "Unipolar characteristics of Carbon Nanotube Field Effect Transistor"

Carbon Nano Tube (CNT) is one of the several cutting edge emerging technologies within Nano technology, that is showing high efficiency and very wide range of applications in many different streams of science and technology. The Carbon Nano Tube Field Effect Transistors (CNTFETs) have been explored and proposed to be the promising candidate for the next generation of integrated circuit (IC) devices. To explore the role of CNTFETs in future integrated circuits, it is important to evaluate their performance. However, to do that we need a model that can accurately describe the behavior of the CNTFETs so that the design and evaluation of circuits using these devices can be made. This paper focuses on compact modeling of CNTFET and analysis of the performance of the developed model using various characteristics. [C343]

#### "Current voltage characteristics of Carbon Nano Tube Field Effect Transistor"

Carbon Nanotube Field Effect Transistors (CNTFET) are promising nano-scaled devices for implementing high performance, very dense and low power circuits. The core of a CNTFET is a carbon nanotube. Its conductance property is determined by the so-called chirality of the tube; chirality is difficult to control during manufacturing. This results in conducting (metallic) nanotubes and defective CNTFETs similar to stuck-on (SON or source-drain short) faults, as encountered in classical MOS devices. This paper studies this phenomenon by using layout information and presents modeling. For CNTFET-based circuits (e.g. intramolecular), these defects are analyzed using a traditional stuck-at fault model. This analysis is applicable to primitive and complex gates. In this paper, we have also developed a simple analytical model for ballistic nano transistors that operate by modulating the charge in the device (as opposed to modulating the current at the contact). This analytical model captures the essential physics of MOSFET-like ballistic nanotransistors and provides a convenient way to assess and compare transistors at the ballistic limit. The circuit simulation was carried out using SPICE model and the current voltage characteristics were obtained. [C344]

#### "Comparative study of different structures of nanosatellite and its analysis"

A satellite basically any object that revolves around a planet in a circular or elliptical orbit path. Nano satellites are satellites that weigh less than 10Kg. These types of satellites are designed and developed to carry payloads that are much smaller and has a life span not more than 1 year generally. Sathyabama University has taken up a task of designing and developing a nano satellite for pollution monitoring. This nano satellite named "SATHYABAMA SATELLITE" is designed to detect the presence of green house gases in the atmosphere and to map them in the later stage. This paper gives a comprehensive view of the structural design and development of such a nano satellite. [C345]

#### "On board communication subsystem for Sathyabama University nano-satellite"



The primary goal of the communication subsystem of any satellite is to establish a communication link between the satellite and the ground station to relay payload and housekeeping data. In this paper, various hardware and software design aspects of the Sathyabama nanosatellite communication subsystem is discussed. Hardware devices chosen for our design includes Microhard MHX-425 ultra low power FHSS radio transceiver, Beacon transmitter, Microchip dsPIC on board processor and monopole antennas. The software written for the dsPIC processor is responsible for encoding telemetry and payload information into standard AX.25 format data packets as well as decoding commands transmitted from the ground station. [C346]

#### **"Detection of water pollution by sonoluminescence technology"**

In recent years, water pollution detection has been global issues, especially for metal and organic pollution. And the phenomenon of ultrasonic cavitation has been widely used in the decades. In this paper, a method of detector water pollution by using sonoluminescence is introduced and some results are showed and analyzed. [C347]

#### **"Joint-PDF of timing and power of nano-scaled CMOS digital gates due to channel length variation"**

This paper presents a method for estimating the joint parametric yield accurately. The statistical yield estimation approach predicts the joint probability distribution function (JPDF) of the gate performance (delay) and power (leakage) considering the channel length variation. This method is applied to primitive gates (NOT, NAND and NOR). To increase the model accuracy, a quadratic relationship between the threshold voltage and the channel length is considered. The relation includes the stacking effect for stacked transistors in complex gates such as NOR and NAND. To assess the accuracy of the approach, its yield estimation results are compared with those of the Monte Carlo simulations. The comparison reveals a very high accuracy with errors less than 3.7% for a 32 nm standard CMOS technology. In addition to the channel length variation, the technique may be extended to the variations of other parameters including temperature, supply voltage, and dopant fluctuation. [C348]

#### **"Micro air vehicle with nano-sensors to capture the enemy's arsenal"**

In this paper, the self organizing neural network approach is proposed in the micro air vehicle, inducted with nano-sensors to capture the enemy's arsenal. It is proposed that the nano-sensors sense the given locations. By using self organizing feature the micro air vehicle flies to the desired locations and capture the objects. The micro air vehicle starts from the base station once all the locations are programmed. The concept of travelling salesman problem (TSP) is used in the micro air vehicle. So the air vehicle flies to the various locations and return back to the initial location. The efficiency of the proposed method is simulated to show its effectiveness. [C349]

#### **"Electronic power supply design for Sathyabama University Nano Satellite"**

This paper presents the practical and theoretical design of the power supply unit (PSU) of the Sathyabama University Nano Satellite. The solar arrays are configured such that the cells of each side on the satellite are connected in series and the four sides are connected in parallel. This configuration has been chosen, because it was found that it is the best trade off between ease of maximum power point tracking(MPPT) and to improve the converter performance. The diodes protect the cells from conducting a reverse current. The battery charge controller acts as a central unit of the electronic subsystem, it takes care of charging the battery unit. It basically transfers power from solar panel to the battery at unregulated bus. The choice of battery configuration and capacity is calculated on the basis of orbital calculation. This battery is also responsible for voltage control of the intermediate power bus between the two converters. The batteries keep the average voltage in the range 6.0-8.4V. This is used to convert the intermediate bus voltage to 5v and 3.3v bus levels for the other subsystem. The simulation results of various converters are shown. [C350]

#### **"Effect of gate fringing and dopant redistribution on the width-dependence of threshold voltage of narrow channel shallow trench isolated MOSFETs"**

This paper demonstrates the effect of gate fringing and dopant redistribution on the width-dependence of threshold voltage of narrow channel shallow trench isolated MOSFETs. Shallow trench isolated MOSFETs have been considered in the 90 nm technology node. The model takes into account the modification of the depletion charge density caused due to dopant redistribution and the enhanced depletion depth at the trench oxide sidewalls due to edge effect caused by gate fringing. The developed model has been validated by comparing the results predicted from the derived model with experimental data, simulation data and also with a similar model available in literature. It has been demonstrated that our model predicts correctly the inverse narrow width effect of nano-scale devices. [C351]



### "Nanophotonics technology for advanced quantum dot/photonic crystal device and metal/semiconductor plasmonic device"

Nano-photonic structures/materials such as surface plasmon and negative-index material as well as quantum dots (QD) and photonic crystals (PCs) are discussed from potentials for new photonic devices and technologies. PC slab waveguides and QDs were developed for key photonic devices such as ultra-small and ultrafast symmetrical Mach-Zehnder (SMZ)-type all-optical switch (PC-SMZ) and an optical flip-flop device (PC-FF). We have studied energy-saving light/matter interaction in a PC waveguide with emphasis on virtual-excitation-based nonlinear effects such as optical Kerr effect. We have also demonstrated a new RGB color filter on Al film with sub-wavelength holes in a large area with a high precision and optical beam-steering device with a wide steering angle. [C352]

### "Nanorobots in cancer treatment"

From eliminating the side effects of chemotherapy to treating Alzheimer's disease, the potential medical applications of nanorobots are vast and ambitious. In the past decade, researchers have made many improvements on the different systems required for developing practical nanorobots, such as sensors, energy supply, and data transmission. A few generations from now someone diagnosed with cancer will be offered a new alternative to chemotherapy. The traditional treatment of radiation that kills not just cancer cells but healthy human cells as well, causing hair loss, fatigue, nausea, depression, and a host of other symptoms. A doctor practicing nanomedicine would offer the patient an injection of a special type of nanorobot that would seek out cancer cells and destroy them, dispelling the disease at the source, leaving healthy cells untouched. The extent of the hardship to the patient would essentially be a prick to the arm. A person undergoing a nanorobotic treatment could expect to have no awareness of the molecular devices working inside them, other than rapid betterment of their health. This paper presents a study on different approaches employed towards cancer treatment using nano robots. Further it also provides an insight into the future scope in this field of study. [C353]

### "High reliability 32 nm Cu/ULK BEOL based on PVD CuMn seed, and its extendibility"

A 32 nm BEOL with PVD CuMn seedlayer and conventional PVD-TaN/Ta liner was fully characterized by fundamental, integrated, and reliability methods. CuMn was confirmed to have fundamental advantages over CuAl, such as higher electromigration (EM) reliability for the same Cu line resistance (R). Both low R and high reliability (EM, SM, and TDDb) were achieved. Improved extendibility of CuMn relative to CuAl was also supported by studies of alloy interactions with advanced liner materials Ru and Co, and by enhancement of ultra-thin TaN barrier performance. [C354]

### "A novel smart nanowire biosensor with hybrid sensor/memory/CMOS technology"

For the first time, a novel smart biosensor with hybrid sensor/memory/CMOS poly-Si nanowire technology has been developed. Special designed oxide-nitride-oxide composite dielectric underneath 50nm nanowire realizes an electrically  $V_{th}$ -adjustable sensor to compensate device variation. The detections of pH, hydrogen peroxide and DNA are demonstrated using various functionalized receptors. A substrate-ionic coupling operation of the buried-channel field-effect sensor exhibits superior pH sensitivity ( $V_{th}$ shift > 100mV/pH) beyond Nernst limitation. The built-in memory of nanowire devices possess steady electrically  $V_{th}$ adjustment ( $V_{th}$ programming/erasing window > 2V), enable portable physiology monitoring and in-situ recording. In this work, we report a fully CMOS-compatible technique for Lab-on-Chip biosensor application. [C355]

### "Performance optimization of CNFET based subthreshold circuits"

Subthreshold circuits are an ideal choice for ultra low power, moderate throughput applications. In subthreshold region to meet the ultra-low power requirement of energy constrained devices, supply voltage less than the threshold voltage is applied. At same frequency, subthreshold circuits show orders of magnitude power saving over superthreshold circuits. In subthreshold operating region, minute leakage current is use as switching current but this limit the performance of logic gate. Primary goal while designing the subthreshold circuit is to increase the speed. Carbon Nano Tube Field Effect Transistors (CNFETs) is one of the most promising devices among emerging technologies. Most of the fundamental limitations of traditional MOSFETs are overcome in CNFETs. This paper investigates the performance analysis of subthreshold circuits and shown improvement in speed of logic gates using CNFETs. This paper primarily investigates the characteristics of CNFETs in subthreshold region. Improvement in performance of FO4, 1-bit full adder and 2:1 multiplexer is observed using CNFET over Si-MOSFET in subthreshold. This paper propose that reducing the gate oxide thickness of CNFET increases drive current and hence speeds with almost same amount of power dissipation. [C356]



### "Statistical study of the effect of process variations on nano-scale CMOS circuits with scaling"

In this paper, we study the effect of the variation of process parameters on the performance of a voltage controlled oscillator (VCO) and an inverter with technology scaling. The spread in performances is shown to be Gaussian in nature, considering the fact that the distributions of process parameters are also Gaussian in nature. The spreads in performances increase with technology scaling. These have been verified through HPSICE simulation results. [C357]

### "Requirement of effective fabless/foundry interactions for achieving robust product reliability"

It is no longer sufficient for foundries to provide only process technology qualification data (for example, device hot carrier, TDDB, BTI, interconnect EM, SM etc.) to the fabless companies as it has been done traditionally. At the nanometer scale, process variations (die to die & within die) coupled with shrinking reliability margins have significantly reduced the design space while circuit designs become increasingly complicated. Foundries need to provide detailed reliability information to enable process-variability & reliability-aware designs that allow the fabless users to leverage the benefits of the advanced technologies. The information is needed for all users and is critical to be available in the process development phase for early technology adaptors. Information should include detailed reliability design rules/tools in form of device/interconnect degradation models that incorporate statistical/process variations. These models/tools can help designers to identify and to mitigate circuit reliability risks in the early design phase. This paper addresses this shift of paradigm that allows fabless designs to keep pace with the rapidly changing nano scale technologies. [C358]

### "Intragrain compositional gradient barium strontium titanate ceramics fabricated by a sol-assisted sintering technology"

Our previous researches show that (Ba,Sr)TiO<sub>3</sub>(BST) ceramics with intragrain compositional gradients possess increased temperature stability, and a sol-assisted sintering technique can significantly reduce the sintering temperature and this favors the further improvement of the ceramic properties. Before sintering, preforms consisting of the mixture of barium titanate (BT) and strontium titanate (ST) powders were infiltrated with a BT sol. In this paper, sintering behaviors and compositional gradation, especially at lower sintering temperature for longer holding time were investigated. Dielectric properties were also measured and discussed. The ceramics' microstructural evolution was examined via scanning electron microscopy. The compositional gradients were studied with X-ray diffraction and energy dispersive spectroscopy. Experimental results showed that the existence of nano-grains formed from the infiltrated sol-gel in the ceramics play a key role in the process of densification. The mechanism of sol-assisted sintering and compositional gradation was experimentally investigated and discussed, which would help to optimize the fabrication scheme. Results suggest that the BST ceramics with intragrain compositional gradients is a promising candidate as tunable microwave elements. [C359]

### "A study on communication aspects of two-dimensional large-scale wireless sensor networks using percolation principles"

A study on primary percolation processes taking place in a two-dimensional large-scale lattice ( $N \times N$ ), which represents a flat wireless sensor nano-network, has been carried out based on numerical simulations using the Monte Carlo method. The communication aspects of this nano-network, such as an average number of hops of the channel which may emerge between nodes placed on the opposite network borders, the channel integrated bit-error-probability as well as a common time of signal transfer through this channel have been investigated as well. Asymptotic dependencies of these parameters for very large network dimensions ( $N \rightarrow \infty$ ) have been established and determined. [C360]

### "Analyzing Carbon Nanotube interconnects in VLSI application"

Single Wall Carbon Nanotubes exhibit outstanding contributions in the recent VLSI interconnections. Interconnects analyzed in VLSI circuits depends on the electrical properties of carbon nanotubes. Metallic carbon nanotubes are very distinct for their ballistic conductivity in nano level interconnections. Different peaks are analyzed in Raman spectroscopy technique for characterizing metallic carbon nanotubes. The performance analysis of metallic carbon nanotubes is compared with the conventional Cu interconnects. In this study we analyzed resistivity and capacitance of carbon nanotubes interconnects which indicates carbon nanotubes interconnect are the most prominent solution for the future VLSI technologies. [C361]

### "Nonlinear controller and observer designs of a CMOS-MEMS nano-newton force sensor"

This paper addresses the design and application of an observer-based nonlinear controller employing a CMOS-



MEMS nano-Newton force sensor. The sensor is designed using AMI 0.5 $\mu$ m 3-Metal 2-Polysilicon CMOS technology capable of sensing an out-of-plane force perpendicular to the probe tip; it is suitable for biomedical applications that measures external force excitation of less than 100 Hz. Measurement errors occur when there are in-plane movements of the probe tip; these errors can be controlled by the actuators incorporated within the sensor. Observer-based controller is necessitated in real-world control applications where not all the state variables are accessible for on-line, real-time measurements, and/or where the measurements are corrupted by noise. [C362]

#### **"Characterization of wideband square spiral inductors based on 0.15 $\mu$ m GaAs pHEMT technology"**

This paper reports on the characterization of non-scalable square spiral inductors based on 0.15  $\mu$ m GaAs pHEMT technology. The effect of number of turns on the electrical characteristics of the spiral inductors were characterized up to 40 GHz with inductances values obtained from 0.241 to 2.436 nH. The inductance and self resonant frequency (SRF) of the square spiral inductors were determined by S-parameter simulations from the Smith chart. Results show that the spiral inductors have resonance frequencies ranging from 13.52 GHz to more than 30 GHz for spiral inductors values from 2.436 nH to 0.241 nH. Using tune-tank circuit topology, the Q factor obtained for the spiral inductors have values ranging from 11 to 16. The spiral inductors behavior was finally represented by a  $\pi$ -network equivalent circuit based from on-wafer S-parameter measurement. [C363]

#### **"Novel silver contact paste lead free solution for die attach"**

Heraeus has developed a novel concept for silver sinter pastes. The new concept uses well known micro scale silver particle technology combined with sinter additives. The novel pastes have higher sinter activity than nano-silver pastes and can be used in pressureless or low pressure bonding processes. The physical properties such as shear strength at temperature above 200°C, electrical and thermal conductivity are outstanding compared to solder or silver adhesives. The new paste concept can reduce the pressure required for "Low Temperature Joining Technology", is an alternative to nano-scaled silver pastes and can be potential lead free solutions for die attach applications. A large variety of applications are possible. [C364]

#### **"Nanonetworks: A new frontier in communications"**

Nanotechnology is enabling the development of devices in a scale ranging from one to a few one hundred nanometers. Nanonetworks, i.e., the interconnection of nano-scale devices, are expected to expand the capabilities of single nano-machines by allowing them to cooperate and share information. Traditional communication technologies are not directly suitable for nanonetworks mainly due to the size and power consumption of existing transmitters, receivers and additional processing components. All these define a new communication paradigm that demands novel solutions such as nano-transceivers, channel models for the nano-scale, and protocols and architectures for nanonetworks. In this talk, first the state-of-the-art in nano-machines, including architectural aspects, expected features of future nano-machines, and current developments are presented for a better understanding of the nanonetwork scenarios. Moreover, nanonetworks features and components are explained and compared with traditional communication networks. Novel nano-antennas based on nano-materials as well as the terahertz band are investigated for electromagnetic communication in nanonetworks. Furthermore, molecular communication mechanisms are presented for short-range networking based on ion signaling and molecular motors, for medium-range networking based on flagellated bacteria and nanorods, as well as for long-range networking based on pheromones and capillaries. Finally, open research challenges such as the development of network components, molecular communication theory, and new architectures and protocols, which need to be solved in order to pave the way for the development and deployment of nanonetworks within the next couple of decades are presented. [C365]

#### **"Radio-frequency nanoelectronics: A new paradigm in electronic systems design"**

Owing to the new qualitative and quantitative improvements that nanotechnology allows, nanoelectronics has the potential to introduce a paradigm shift in electronic systems design similar to that of the transition from vacuum tubes to semiconductor technology. Since many nano-scale devices and materials exhibit their most interesting properties at radiofrequencies (RF), nanoelectronics represent an enormous and yet largely undiscovered opportunity for the microwave engineering community, which can utilize its established body of modelling, design and measurement techniques with the aim to bridge the gap between nano-science and a new generation of extremely integrated devices, circuits and systems, for a broad range of applications and operating frequencies covering the radiofrequency (RF) spectrum, through the microwave region, and up to the optical region. In this contribution, examples of recent achievements in new nanotechnology-based radio-frequency devices and systems are presented. This is done, in particular, by focusing the areas of carbon-based and terahertz nanoelectronics. [C366]



### "Power semiconductor joining through sintering of silver nanoparticles: Evaluation of influence of parameters time, temperature and pressure on density, strength and reliability"

For decades soldering has been the technology of choice in die bonding. However, due to worldwide health regulations, the most common solder alloys, which contain lead, have been banned. Furthermore, standard solders cannot fulfil the reliability requirements of future power electronic devices. New interconnection technologies have to be developed. One of them is pressure sintering of silver flakes, which forms a highly reliable, highly thermally conductive bond. However, the level of pressure needed (30-50 MPa) requires a powerful pressing equipment and can lead to cracking of the devices and ceramic substrates. A promising development is the use of nano-scaled silver particles, which can be sintered using less pressure due to their superior sintering properties. Preceding thermogravimetric and calorimetric analyses showed that the presence of oxygen eases the sintering of silver nanoparticles. In order to grasp the sintering characteristics of interconnection layers consisting of nano-scaled silver, sintering experiments were conducted in both air and nitrogen. Scanning electronic microscope pictures and density measurements with a laser profilometer show that sintering of the nano-scaled silver in air but under a chip, the case of real interest, is closer to uncovered sintering in nitrogen than in air. Densities remain lower and the microstructures more fine-grained. This is due to limitation of diffusion of organics out of and oxygen into the layer. The application of pressure can make up for this in terms of density. Hence, the increase in density of stencil printed layers of nano-silver when sintering at temperatures ranging from 200 to 300°C, pressures between 0 and 30 MPa, and for a time of up to 1800 s was measured. The density can be set to any value between 60% and 90% of bulk silver by adjusting sintering time and the levels of temperature and pressure. Samples for shear tests were built using dummy chips made of silver-coated copper. The--y show that after 60 s of sintering at 275°C and 5 MPa a good shear strength of 40 MPa had been established. If the remaining parameters are set correctly, even 5 s of sintering, a temperature of 225°C, or a pressure as low as 2 MPa is sufficient to generate bonds comparable to solder and high pressure sinter joints. [C367]

### "The properties of nanocomposite (BiDy)<sub>3</sub> (FeGa)<sub>5</sub> O<sub>12</sub> :Bi<sub>2</sub> O<sub>3</sub> magneto-optic garnet films for applications in nanophotonics, ultrafast switching and integrated optoelectronics"

We investigate the properties and applications of newly-developed RF-sputtered nano-composites with record-high magneto-optic quality (exceeding 25° at 532 nm and 42° at 635 nm). Bi-substituted dysprosium-gallium iron garnet layers with excess co-sputtered bismuth oxide content are demonstrated to possess very attractive optical and magnetic properties, which makes them suitable for novel magneto-optic and nanophotonic applications. [C368]

### "Rapid Emergence and Convergence of Electronic Technologies as Multiplying Factor for Innovation Capability"

This key note speech outlines the 4-Es related to electronic industry: 1. Explosion through multi-pronged fundamental research in materials etc, has significantly contributed towards efficient, cost-effective and small-in-size electronic systems. 2. Emergence of new technological domains like molecular (micro & nano) electronics which are seeing huge application potential. 3. End-use of these technologies across industries in the today's scenario. 4. Extrapolation towards future technologies for 2050! [C369]

### "A Taylor Expansion Diagram Approach for Nano-CMOS RTL Leakage Optimization"

Due to exponential behavior of gate-oxide leakage current with temperature and technology scaling, leakage power plays important role in nano-CMOS circuit. In this paper, we present simultaneous scheduling and binding algorithm for optimizing leakage current during behavioral synthesis. It uses TED (Taylor Expansion Diagram) for generating optimized DFG (Data Flow Graph). Once DFG is obtained, it selectively binds non-critical components to corresponding functional unit consisting of transistors of high oxide thickness and critical components with low oxide thickness. As the algorithm considers time-constraint explicitly, it reduces leakage current without degrading the performance of the design. Experimental results on a set of behavioral synthesis benchmarks for 45 nm process show 30% to 70% reduction in leakage current compared to the results obtained by a conventional optimization flow. [C370]

### "RDF effect induced by source/drain doping in nano-scale UTB SOI MOSFET with nominally un-doped channel"

SOI MOSFETs with un-doped channel are generally considered immune to random dopant fluctuation (RDF) effect. However in ultra-small MOSFETs, the lateral extension distribution of source/drain (S/D) impurity can make the "nominally" un-doped channel considerably doped, thus very likely resulting in an unexpected



noticeable RDF effect. In this work, we investigate the unexpected RDF effect in UTB SOI MOSFETs with undoped channel by device simulation. Results show that, for sub-20nm gate length devices, the S/D doping abruptness ( $\delta$ ) is required to be around 1 nm/dec to have an acceptable  $V_{th}$  variation caused by the unexpected RDF effect. This requirement seems too difficult to meet in the present or near future technologies. A new limit to scaling nano-scale SOI devices is thus revealed. [C371]

### "Phase change materials and random access memory"

Shanghai institute of micro-system and information technology (SIMIT) began the research work in PCM technologies from 2003. This report will systematically introduce the recent progress of the PCM group led by Prof. Song. The main contents include: 1) the significance of R&D on PCM, 2) platform construction, 3) research on novel phase change materials like nano composite material (phase change material with dielectric material), multilayer phase change material, and buffer layers, 4) novel experimental methods on finding novel phase change materials like material library and high density PCM array fabrication using FIB platform, 5) phase change material engineer on 8-inch processing line, 6) theoretical simulation of 1R unit, driving device, circuit, and novel phase change materials, and 7) key technologies of developing PCM chips including diode process, nano electrode fabrication,  $\text{Ge}_2\text{Sb}_2\text{Te}_5$  (GST) hole filling and CMP, GST etch, and chip design and the latest test results. [C372]

### "Impact of metal nano-grating phase-shift on plasmonic MSM photodetectors"

In this paper, finite difference time-domain (FDTD) method is used to simulate the light absorption enhancement in a plasmonic metal-semiconductor-metal photodetector (MSM-PD) structure employing a metal nano-grating with phase-shifts. The metal fingers of the MSM-PDs are etched with appropriate depths to maximize light absorption through plasmonic effects into a subwavelength aperture. Simulation results show that the nano-grating phase-shift red-shifts the wavelength at which the light absorption enhancement maximum, and that the combined effects of the nano-grating groove shape and the nano-grating phase-shift, degrade the light absorption enhancement by up to 50%. [C373]

### "Design of high-sensitivity plasmonics-assisted GaAs metal-semiconductor-metal photodetectors"

In this paper, we use the finite difference time-domain (FDTD) method to optimize the light absorption of an ultrafast plasmonic GaAs metal-semiconductor-metal photodetector (MSM-PD) employing metal nano-gratings. The MSM-PD is optimized geometrically, leading to improved light absorption near the designed wavelength of GaAs through plasmon-assisted electric and magnetic field concentration through a subwavelength aperture. Simulation results show up to 10-times light absorption enhancement at 867 nm due to surface plasmon polaritons (SPPs) propagation through the metal nano-grating, in comparison to conventional MSM-PD. [C374]

### "Design of Arithmetic Circuits Using Reversible Logic Gates and Power Dissipation Calculation"

In the recent years, reversible logic has emerged as a promising technology having its applications in low power CMOS, quantum computing, nano technology and optical computing. Reversible logic circuits provide less power dissipation as well as distinct output assignment for each distinct input. The classical set of gates such as the NAND, AND, NOR, OR, XOR and XNOR are not reversible. This paper aims at finding a reversible counterpart of all the irreversible basic logic gates and developing full custom layout of all these gates with reversibility using 0.25  $\mu\text{m}$  technology to synthesize as well as simulate them to check their correctness. Attempts have been taken to minimize the circuit of all the logic gates using CMOS while making them reversible. Further the reversible logic has been utilized to design the reversible full adder and half adder. Using those gates, 4-bit Binary Parallel Adder and 4x4 multiplier circuit are also designed. Thus, this paper provides the initial threshold to building of more complex system which can execute more complicated operations using reversible logic. [C375]

### "Nano-CMOS Mixed-Signal Circuit Metamodeling Techniques: A Comparative Study"

Fast design space exploration of complex nano-CMOS mixed-signal circuits is an important problem. In this paper, a design process flow that uses metamodels is introduced. In this flow the most important task is the sampling of the design space. In this paper, different sampling techniques for producing an accurate metamodel are investigated to minimize the number of samples required by using a nano-CMOS ring oscillator (RO) as an example. Through SPICE simulations, it is shown that the parasitics have a drastic effect on performance metrics, such as the frequency of oscillation. Alternative sampling techniques, both random, such as Monte Carlo (MC), and uniform, such as Latin Hypercube Sampling (LHS), and Design of Experiments (DOE), are considered as and compared for speed and accuracy. Due to the time constraints of the circuit design process, this paper can be used as a guideline for which sampling technique will produce the most accurate result to minimize the design time. All experimental results are presented for a 45 nm technology. [C376]



### "Development of carbon nanotube based biosensor fabrication for medical diagnostics application"

Summary form only given. Carbon nanotubes are tiny hollow cylinders, made from a single grapheme sheet, that possess many amazing properties. Spurred by the Human Genome Project, deoxyribonucleic acid (DNA), carbon nanotube based biosensors are indispensable tools in molecular biology. A biosensor is an analytical device which converts a biological response into an electrical signal. A SWNT can be metallic, semiconducting, or semimetallic, depending on its chirality. Carbon materials have been used as components in biosensors for over a decade. Carbon nanotubes (CNT) chemical functionalization can be used to attach almost any desired chemical species to them, which allows us for instance to enhance the solubility and biocompatibility of the tubes. This has permitted the realization of composite electrodes comprising CNTs well-dispersed in an appropriate polymer matrix. DNA hybridization biosensors offer considerable promise for obtaining sequence-specific information in a faster, simpler and cheaper manner compared to traditional hybridization assays. These technologies rely on the immobilization of a single-stranded DNA probe onto different physicochemical transducers that convert the hybridization event into an electrical or optical signal. Applications for this technology are numerous and far reaching, including identification of pathogens, gene expression monitoring, diagnosis of genetic disorders and forensic examination. In this project, carbon nanotube based biosensor was fabricated on p-type silicon wafer which was coated with 100 -200 of silicon dioxide, titanium 100 -200 were grown and followed with 900 -1000 of Aurum. This metal multilayer is used for interconnections and reacts as conduction element for biosensor based carbon nanotube device. Silicon dioxide with the thickness of 300 - 400 was grown once again, titanium of 100 -200 thick was grown and followed with 900 -1000 of Aurum. The distance between these two electrodes is 3-4  $\mu\text{m}$ . Carbon nanotubes were deposited using dielectrophoresis and nanomanipulation method. The diameter of SWNT was around 1.2nm -1.5 nm. Small amount of SWNTs were ultrasonically dispersed in an aqueous solution for 30 minutes, then a small drop was casted the wafers in between the pairs of metal multilayer electrodes. AC bias was applied and the peak-to-peak AC voltage was between 4 and 8 V, and the frequency was fixed at 10 MHz to 50 MHz. Once the resistance drop was detected, the AC bias was turned off immediately. To improve the integration between the SWNTs and electrodes, this device was also annealed at 300°C for 15 minutes. AFM nanomanipulation takes place to ensure the placements of all SWNTs were successful. Nitride was grown to form a test channel for electrical and final testing. In this project development, we provide an introduction to biosensors based on carbon nanotubes. These carbon nanotube electrodes have very high sensitivity to detect biomolecules. For decades, the manipulation and placement of carbon nanotubes has always been research thoroughly. Dielectrophoresis and nanomanipulation method has been applied on this project because it has really big advantage over random spin coating and direct growth of carbon nanotubes. This project is currently in progress on integration of carbon nanotube and the procedure to apply the DNA onto the device using deoxyribonucleic acid (DNA) hybridization process. [C377]

### "High-mobility Ge nano-stripes for next generation Si-CMOS"

Research and development for new semiconductor devices which enable ultrahigh speed operation and ultralow power dissipation are strongly required to overcome the scaling limit of the transistor performance. In line with this, Si-based heterostructure technologies have been widely developed. Recently, we have developed SiGe mixing triggered liquid-phase epitaxy (LPE). This achieves high-mobility Ge single crystals on insulating substrates [1]. The present paper reviews our recent progress in this novel growth technique. [C378]

### "Fabrication and characterization of a-Si micro and nano-gap structure for electrochemical sensor"

This paper presents the fabrication and electrical characterization of a-Si micro and nano-gap structure. Conventional UV lithography technique and dry etching for a-Si layer with wet etching for Al surface processes are used to fabricate the micro and nanogap based on the standard CMOS technology and characterization of its conductivity. The electrical characterization are applied by using semiconductor parameter analyzer (SPA), spectrum analyzer, IV-CV station for electrical characteristic, conductivity, resistivity and capacitance test is performed to characterize and check the structure of the device, which resulted in a small microgap as revealed by further I-V curve result that showed a current in nano amps. [C379]

### "A 1.8GHz Voltage-Controlled Oscillator using CMOS technology"

A Voltage-Controlled Oscillator (VCO) for 1.8GHz application has been designed using a combination of both 0.13 $\mu\text{m}$  and 0.35 $\mu\text{m}$  CMOS technology. The VCO has a large tuning range, which is from 1.39GHz to 1.91GHz, using a control voltage from 0 to 3V. The VCO exhibits a low phase-noise at 1.8GHz which is around -119.8dBc/Hz at a frequency offset of 1MHz. [C380]

### "Creation of nanostructures via self-assembly at room temperature, cluster structures and



### dynamics, and bio-nano fusion technology"

Creation of nanostructures utilising near-critical fluids: The gas-liquid coexistence curves terminate at the critical point. As fluids approach their critical points, large molecular clusters are formed and as a result, the physical properties such as the specific heat and compressibility diverge. A variety of nanostructures are formed via self-assembly near the critical points. I show carbon onions, coils, fibres and other interesting structures created in near-critical carbon dioxide, ethane, xenon, benzene and their mixtures. Structures and dynamics of clusters composed of magnetic particles: Various structures are formed by magnetic particles via anisotropic dipole-dipole interactions. The cluster structures and dynamics can be actively controlled by external magnetic fields such as dc, ac and rotational ones. I show self-organised structures and dynamics of clusters composed of ferromagnetic and superparamagnetic particles. Application of cluster dynamics to the development of bio-medical devices: Biomolecules and cells can be labelled by magnetic particles and CNTs and therefore can be manipulated and sorted quite easily by applying external magnetic fields. Biomolecules and cells can also be manipulated utilising the magnetic hole effect, in which case labelling is not necessary. I explain a new nano/micro technology for a quick detection of diseases and allergies utilising the interactions between magnetic particles/CNTs and biomolecules/cells in external magnetic fields. [C381]

### "Three-dimensional nanostructure fabrication by focused-ion-beam chemical vapor deposition"

Three-dimensional nanostructure fabrication has been demonstrated by 30 keV Ga<sup>+</sup>-focused-ion-beam chemical-vapor-deposition (FIB-CVD) using a phenanthrene (C<sub>14</sub>H<sub>10</sub>) source as a precursor. Microstructure plastic arts is advocated as a new field using micro-beam technology, presenting one example of micro-wine-glass with 2.75µm external diameter and 12µm height. The deposition film is a diamondlike amorphous carbon. A large Young's modulus that exceeds 600 GPa seems to present great possibilities for various applications. Producing of three-dimensional nanostructure is discussed. Micro-coil, nanoelectrostatic actuator, and nano-spacewiring with 0.1 µm dimension are demonstrated as parts of nanomechanical system. Furthermore, nanoinjector and nanomanipulator are also fabricated as a novel nano-tool for manipulation and analysis of subcellular organelles. [C382]

### "Nanostructured materials in advanced membrane technology for separation processes"

Separation by selective transport through membranes is a dynamic and rapidly growing field. However, the existing of polymeric and inorganic membrane materials are inadequate in terms of sustaining the membrane performance for long term operation under high pressure and high concentration of impurities to be separated. These are some of the key issues to be addressed by scientist and engineers to fully exploit membrane technology in a broader perspective. Thus, to address the key issues, Mixed Matrix Membrane (MMM) has been developed. MMM composed of homogeneously interpenetrating polymeric and inorganic particle matrices offers a viable and promising route that has been rapidly researched and is an attractive candidate for membrane-based separations processes. The combination of polymer and inorganic filler in MMM resulted in a synergistic effect in which the rigid adsorptive porous type inorganic phase provides superior separation properties, meanwhile the presence of flexible polymer enables the ideal membrane forming hence solving the problem of fragility inherent found in the inorganic membranes. In the fabrication of MMMs, the polymeric layer is normally tightly packed with nano-inorganic fillers such as zeolite, carbon molecular sieve as well as carbon nanotube to form a dense region of mixed matrix layer. These nanoporous materials possess the shape and size selective nature and hence allow molecular sieving discrimination by permitting smaller sized penetrates to diffuse at higher rate than that of larger sized. The practical utilization of MMMs for particular separation processes can only be achieved only if the intrinsic properties of the MMM is fully optimized. In this aspect, the selection of proper filler and adaption of modification to enhance the filler compatibility are crucial steps to be taken into consideration in order to facilitate and also bring a new insight into a wider application of MMMs. [C383]

### "Nanosensors for ubiquitous network"

In this paper MIMOS and the R&D work on the nanomaterials for sensing elements and of material functionalization will be pursued towards application of sensors. The facility for nanomaterial growth is already available together with other equipments for material characterization such as atomic force microscopy (AFM), scanning electron microscopy (SEM) and transmission electron microscopy (TEM) to determine surface morphology, grain size and structure; small angle X-ray scattering (SAXS) for particle size distribution; and Raman spectroscopy to characterize the stress in materials and chemical binding. In this presentation, some of the work in the realization of nanosensor materials and their characterization will be disclosed. The availability of a 0.35µm wafer fabrication facility in MIMOS also allows us to fabricate nanostructures using standard semiconductor technology for application in nano-electromechanical sensors. In MIMOS, we are able to fabricate polysilicon, silicon dioxide, silicon nitride and tungsten nanostructures with dimensions down to 10 nm on an 8" silicon wafer by spacer technology. [C384]



### "An analytical model for sidewall parasitic capacitance of nano-scale trench isolated MOSFETs"

This paper presents a physics-based, analytical model for sidewall parasitic capacitance of nano-scale MOSFETs. Trench isolated MOSFETs have been considered in the 90 nm technology node. An analytical expression for the trench oxide parasitic capacitance is derived by taking into account the enhanced depletion depth caused due to gate fringing field at the trench oxide sidewalls and dopant redistribution in the channel. The sidewall parasitic capacitance is calculated using conformal mapping technique. The developed model has been validated by comparing the results predicted from the derived model with simulation data and with a similar model available in literature. It has been demonstrated that our model determines more correctly the parasitic capacitance of nano-scale devices compared to the existing model. [C385]

### "Fabrication of multilayer interconnection materials and bonding film for high integration applications"

To meet the demands for increased integration and multi functions for multilayer electronic components the related materials and process technique for layer-to-layer interconnection have to be developed together. Using nano-, micro-sized metal powders and epoxy resins conductive via pastes have been formulated. Via conductance was measured before and after solder floating (288 °C) to observe the change rate after thermal shock. Thermal conductivity of fabricated paste was evaluated by making disk-type pressed specimens. As the results, the electrical conductivities of tested pastes showed the values of about 10-5 Ωcm. Trimodal pastes showed better solder shock resistance than bimodal pastes. Thermal conductivities over 15 W/mK were obtained from several paste compositions. Also regarding higher integration demands bonding film was developed. Composite material composed of epoxy based resin with inorganic fillers was used due to low process cost, good processability, and low temperature curability. As a result bonding film with glass transition temperature over 170 °C, peel strength above 7N/cm and fine patterning of line space width of 15 μm was fabricated. [C386]

### "Nanofiber based composites for thermal management"

Since the invention of the integrated circuit increasing transistor integration density has been the main path to increased performance of microelectronic devices. With traditional transistor scaling approaching fundamental limitations, the field of electronic packaging has seen increasing effort towards increased integration density, e.g. three-dimensional packaging. Overall, this has led to tremendous power densities in the order of 100 W/cm<sup>2</sup>. Consequently, thermal management of electronic packages has attracted increasing research interest and has been identified as a research priority by industry consortia I NEMI and ITRS. There is a wide consensus within the microelectronics industry that current thermal interface materials constitute a bottleneck hindering a reduction of junction to ambient thermal resistances to future required levels (< 0.2 K/W). Hence, there has been a significant increase in research towards improved thermal interface materials. A clear trend observed in thermal interface materials research is the shift from traditional particulate composites, i.e. randomly dispersed high thermal conductivity particles in polymer matrices relying on percolation mechanisms, towards structured composites providing thermal conductivity through a continuous high thermal conductivity phase. In combination with the application of nanotechnology a number of interesting composite materials have been realized, based on e.g. vertically aligned silver and nickel nanowires and carbon nanotubes. In this paper we introduce and discuss a new type of composite based on nanotechnology for thermal management applications. The core technology behind the composite is electrospun nanofibers. Electrospinning is a method for fabrication of polymeric fibers with diameters in the nano- and micrometer range, offering high flexibility in terms of choice of materials. A huge number of polymeric materials have been electrospun and documented in literature, including various polymeric precursors (e.g. to carbon fibers). In this work we present films of electrospun fibers based on a flexible thermoplastic polyurethane elastomer (Desmopan 9370A, Bayer Material Science AG) and high temperature resistant polyimide (Matrimid 5218, Huntsman Advanced Materials). A typical electrospun polyimide film is exhibited in figure 1. As seen in the image, the film is composed of randomly oriented fibers (mean diameter 780 nm) forming a three-dimensional porous polymer structure. The porous polymer film is liquid phase infiltrated with a metal (typically In, Sn, InSnBi and similar alloy systems) under high pressure (30 MPa), leading to the formation of a topologically connected metal network within the polymeric structure (see figure 2). High thermal conductivity is achieved via the continuous metal phase, while the polymeric phase defines geometry (bondline thickness) and composition. In contrast to pure solder interfaces, the inclusion of a polymeric phase lowers stiffness, indicating a potential for lower bondline-thicknesses while still absorbing CTE-mismatch in assemblies. Results from xenon flash thermal characterization of a representative composite; polyimide infiltrated with pure indium, sandwiched between two copper plates is exhibited in figure 3. As seen, the composite exhibits a total contact resistance (2 interfaces) of 8 Kmm<sup>2</sup>/W. The thermal conductivity is found to be 28 W/mK, approximately 1/3 of the inherent thermal conductivity of the indium metal phase (83.7 W/mK). This clearly indicates the potential of the material in thermal management applications. [C387]



### "Systematic defect identification through layout snippet clustering"

Systematic defects due to design-process interactions are a dominant component of integrated circuit (IC) yield loss in nano-scaled technologies. Test structures do not adequately represent the product in terms of feature diversity and feature volume, and therefore are unable to identify all the systematic defects that affect the product. This paper describes a method that uses diagnosis to identify layout features that do not yield as expected. Specifically, clustering techniques are applied to layout snippets of diagnosis-implicated regions from (ideally) a statistically-significant number of IC failures for identifying feature commonalities. Experiments involving an industrial chip demonstrate the identification of possible systematic yield loss due to lithographic hotspots.

[C388]

### "Parity prediction synthesis for nano-electronic gate designs"

In this paper we investigate the possibility of using commercial synthesis tools to build parity predictors for nano-electronic gates designs. They will be used as redundant resources for robustness improvement for future CMOS technology nodes. [C389]

### "A fine line/space fabrication process on flexible polyimide film using laser direct writing method by photothermal effect of silver nanoparticles"

This article describes a fine line/space fabrication process on flexible polyimide film using laser direct writing method by photothermal effect of silver nanoparticles. Since the AgNPs have a strong optical absorption at 405 nm, a UV laser (405 nm, 60 mW) is used to trigger AgNPs to convert light into heat due to photothermal effect of nanoparticles. After UV laser beam irradiating on the AgNPs thin film, the AgNPs aggregate into larger conducting grains and improve the adhesion between AgNPs and the polyimide substrate at the same time. Then the desired AgNPs conductive lines (line width: 10  $\mu\text{m}$ , line space: 20  $\mu\text{m}$ ) are formed after washing the unirradiated AgNPs. Copper plating is also used to increase the electrical conductivity of the laser direct patterning of AgNPs conductive lines. In this method, the conductive line patterns can be made by a low power consumption process ( $< 60$  mW) and with high energy transformation efficiency due to photothermal effect of nanoparticles. [C390]

### "Interfacial reaction at 250°C in the Sn/Ni-7wt.%V couple"

Sn is the base element of all the promising electronic solders, and Ni-7wt.%V is the major diffusion barrier layer material of flip chip technology. Interfacial reactions in the Sn/Ni-7wt.%V couple at 250°C are examined in this study. The Ni<sub>3</sub>Sn<sub>4</sub> phase is observed in the Sn matrix. Two phase layers, Sn-Ni-V ternary phase (T phase) and a mixture of the nano-crystalline V<sub>2</sub>Sn<sub>3</sub> phase and Sn phase (T<sub>2</sub> phase), are observed at the Sn/Ni-7wt.%V interface. The micro structures of T phase and T<sub>2</sub> phase was analyzed by TEM, T phase has a dense structure and T<sub>2</sub> phase has a loose structure. The loose structure of Sn-V phase can not only cause a harmful effect on mechanical properties, but also on electrical properties. [C391]

### "Life prediction of high concentration photovoltaic modules subjected to thermal cycling test"

Due to stringent environmental regulations, a solar power plant that produces energy without pollution has gained more attention in recent years. The high-concentration photovoltaic (HCPV) module is one of the popular solar energy systems due to its small deployed area and high conversion efficiency. However, it may also be subjected to higher temperature in the operating environment. The degradation of the solder layer of the HCPV module would increase its thermal resistance and become the main cause of its reduction in conversion efficiency. In this study, the combination of power and thermal cycling test condition was performed in transient thermal finite element analysis to estimate the variation in junction temperature of a solar cell. The junction temperature could increase due to solder degradation. The lifetime of analyzed HCPV module could be predicted based on the degradation rate of the solder layer. [C392]

### "Metal-to-metal bonding technology for MEMS application"

Summary form only given. Accompanying of MEMS sensor using in consumer production widely, system in package (SiP) technology becomes popular to integrate CMOS device (such as ASIC or DSP) with MEMS sensor together. It is excellent to connect sensor to signal amplifier directly to deduce RC delay and board level noise. However, with CMOS technology evolution to 0.13  $\mu\text{m}$  or 90 nm, the thermal stability temperature of low k IMD material (such as black diamond or a-F:C) is around 400°C. That means for this CMOS/MEMS SiP technology, the first challenge is to develop low temperature process, which has to be compatible with the thermal budget of the CMOS devices. In this paper, the temperature target is set as 350 °C for this concern.



Secondly, the next challenge is the manufacturing method for this CMOS/MEMS SiP technology. Three common manufacturing schemes are chip-to-chip (C2C), chip-to-wafer (C2W) and wafer-to-wafer (W2W), and the specifics of the product will determine which approach has to be taken. The related concerns are including wafer size, die size, alignment accuracy and individual yields issue. In this paper, C2W approach is employed for the constraints in different die size and know good die (KGD), especially in bonding yield rate below 98%. The third challenge is to provide interconnection and hermetic at same time. For certain MEMS device, such as RF MEMS, vacuum or atmosphere is a necessity and influence sensor performance directly. For traditional glass frit or AuSi eutectic bonding, the process temperature is always higher than 400 °C and can't provide interconnection well. Therefore, metal-to-metal (M2M) technology is focused recently to provide not only high quality hermetic but also fine pitch interconnection. In this paper, two kinds M2M bonding systems are developed below 350 °C, which are AuAu diffusion bonding and AuCuSn eutectic bonding. FIB analysis and die shear test are used to understand the influence of material, thickness and process selection in bonding quality. Besides, those two different systems will be compared in considering of wafer topography tolerance and MEMS integration issue. Consequentially, we will demonstrate the application with MEMS package and MEMS device with those two kinds M2M bonding technology respectively. For MEMS sealing package, the general seal ring width used is 100µm, which is better than glass frit (200µm) when device size shrinking. For MEMS device, diaphragm-type device are used to stacking CMOS and MEMS to form multilayer device. Finally, we also will introduce some new bonding concepts in undergoing or future works, such as different material system or nano-technology. [C393]

### "Determination of tensile properties of lead-free solder joints using nanoindentation"

In this work, determination of tensile properties using depth-sensing technique has been demonstrated. An empirical model has been used to extract tensile properties of bulk pure Sn and lead free solder joints using nanoindentation technique. New scheme is proposed based on the non-linear curve fitting analysis of indentation load-displacement data. Elastic modulus, yield strength, perfect plastic hardness and strain hardening parameter of pure tin are derived from the complete indentation load-displacement data. This method is further extended to the nano-indentation experiments on various lead-free solder joints of 500µm size. Elastic modulus, yield strength, perfect plastic hardness and strain hardening parameter of bulk Sn and lead-free solder joints are compared with reported data. [C394]

### "VCCT and integral concepts of bi-material interface fracture in low-k structures-Going to understand relation"

As a consequence of increasing functional density and miniaturization in microelectronics new low-k and ultra-low-k materials are going to be increasingly used in Back-end of line (BEoL) layers of advanced CMOS technologies. These ongoing trends cause novel challenges for reliability analysis and prediction of relevant electronics assemblies. The optimization of fracture and fatigue resistance of those BEoL structures under manufacturing/package (during lead-free reflow-soldering, in particular) as well as chip package interaction (CPI) aspects is a key for further enhancements see also. In particular in this context the evaluation of the risk of delamination at bi-material interfaces and damaging and cracking of materials needs to be improved. The application of advanced finite element techniques combined with experimental observations and validations, provide a way to gain more fundamental knowledge and ultimately, to understand, predict and prevent reliability issues. However, cracking and delamination risk evaluations hang behind the needs especially for nonlinear, transient, thermal loading of bi-material interface fracture. At this point, the correct mode mixity separation at bi-material interface cracks is a precondition for proper delamination risk evaluation. However, different approaches are known to be dependent on mesh density, integration path and/or reference length. We discuss the use of VCCT and integral fracture concepts for bulk and bi-material interface fracture in multi-scale and multi-failure modeling approaches. Energy release rate (ERR), stress intensity factors (SIF) and the related phase angles as results of the different approaches will be investigated and compared. Analytic relations between them will be pointed out and verified. Therefore, the frequently investigated role of reference length, normalizing length and path dependence for the calculation of the fracture parameters is discussed. Effects on the fracture parameters are finally-discussed related to the cracking risk of BEoL structures. The authors combine these numerical approaches with experimental results in order to optimize the toughness for bulk material fracture and interface delamination with regard to structural modifications. [C395]

### "Fast-response polyimide/multiwall carbon nanotube composite films for monitoring humidity in microelectronic packages"

In the present study, fast response resistive-type PI/multiwall carbon nanotube (MWNT) composite films were demonstrated. A composite film with a loading of 3 wt% MWNTs (PIC30) possesses a very linear response nature, a linearity correlation ( $R^2$ ) of 0.99157 and a sensitivity of 0.00146/%RH. The response time were less than five seconds and the resistance changed synchronously with different humidities. The recoverable and



repeatable resistive responses affirmed the high efficiency of this film for fast humidity detection. A negative temperature effect was found and proper temperature compensation should be considered in the future applications. The surfaces of the films were found as an organized structure with nano-size dimples, which is helpful for absorption of water molecules. The proposed sensing mechanisms are discussed and it related with tunnel effects, doping of MWNTs by water and a barrier effect between MWNTs. [C396]

#### **"An approach for an industrial method for the in-situ characterization of thermal interface materials"**

In this paper an approach for the in-situ testing of cutting-edge thermal interface materials (TIM-s) is presented. The novel method is based on existing measurement standards and allows quick and repeatable thermal conductivity measurements on newly developed nano-composite based thermal greases in an application-like environment. During the development of the measurement system both the effect of the quality of the material and the effect of the surface roughness of the DUT fixture on the actual results were taken into account. It is also explained how this method could be applied for the long term reliability testing of TIM-s before introducing them to the industry. [C397]

#### **"From the future Si technology perspective: Challenges and opportunities"**

As silicon technology enters sub-20nm nodes, new materials, structures and processes are being introduced in order to continue with the advantages of dimensional scaling, e.g. 3D NAND, ReRAM, EUVL, etc. Beyond 10 nm, Si CMOS technology will remain as the mainstream. In this paper, key drivers for silicon-based nano-electronics as well as research directions will be reviewed from viewpoints of system, memory, logic and emerging Si technologies. [C398]

#### **"Intrinsic variability in nano-CMOS design and beyond"**

It is widely recognized that process variations will have profound impact on nearly all aspects of future IC design. Depending on their sources, they are often categorized into two types: intrinsic variations and process-induced variations [1][2]. Process-induced variations are caused by the imperfection in silicon fabrication, varying from foundries to foundries. On the other side, intrinsic variations, induced by atom-level charge and geometry fluctuations, are inherent to the device structure. They are limited by fundamental physics, posing one of the ultimate barriers to continual technology scaling. Examples of intrinsic variations include random dopant fluctuation (RDF), line edge roughness (LER), and oxide thickness fluctuation (OTF) [2]. Their importance is rapidly increasing as device feature size approaches the atom dimension. [C399]

#### **"Evolution of shear strength and microstructure of die bonding technologies for high temperature applications during thermal aging"**

Wide bandgap materials have become very attractive for power electronics due to their physical properties that allow junction temperatures up to a theoretical limit of 600°C. In contrast, the maximum operation temperature of conventional silicon semiconductors is limited to approximately 200°C. The high-temperature operation of wide bandgap switches allows an increasing power density of power converters due to the reduced complexity of thermal management systems, leading to highly miniaturized power converters for example for automotive and aircraft applications. However, the reliability of wide bandgap devices at high temperatures is limited by the maximum operation temperature of conventional interconnection materials. The aim of this study is to investigate die attach technologies that are suitable to fulfill high temperature and high power requirements. Therefore, this work focuses on solder joints made of gold-germanium (AuGe12), zinc-aluminum (ZnAl15), and lead tin (PbSn5) alloys, as well as die bonding by low temperature sintering of silver nano particles. For this reason, the evolution of the interfacial microstructure of test devices, assembled with different high temperature die attachment technologies, were monitored using cross sectioning techniques and scanning electron microscope (SEM) images. The evolution of the shear strength with time during high temperature storage was investigated. A comparison between shear test results and the evolution of the microstructure is given. The results show that sintered test devices feature a much higher shear force after high temperature storage due to the proceeding sintering of the particles, while the mechanical stability of all solders decreases with storage time. [C400]

#### **"X-ray computed tomography for nano packaging-a progressive NDE method"**

The challenge of nano-packaging requires new nondestructive evaluation (NDE) techniques to detect and characterize very small defects like transportation phenomenon, Kirkendall voids or micro cracks. Imaging technologies with resolutions in the sub-micron range are the desire. High end semiconductor industries today deal with functional structures down to 32 nm and below. ITRS roadmap predicts an ongoing decrease of the "DRAM half pitch" over the next decade. Nano-packaging of course is not intended to realize pitches at the nanometer scale, but has to face the challenges of integrating such semiconductor devices with smallest pitch



and high pin counts into systems. System integration (SiP, SoP, Hetero System Integration etc.) into the third dimension is the only way to reduce the gap between semiconductor level and packaging level interconnection. To control the necessary technologies a selection of suitable and effective non-destructive evaluation methods is absolutely vital. The task of these methods is not only to identify any impurities on the package surface, but also to look as deep as possible into the package volume. Available non-destructive evaluation methods (NDE) for such kind of packaging are for example X-ray microscopy, X-ray computed tomography, ultrasonic microscopy and thermal microscopy. The paper will focus on X-ray nano focus computed tomography. It will discuss the potentials and limits of X-ray NDE techniques and the sample preparation, illustrated by the investigation of a complete system in package device (SiP). More examples like cracks in solder joints, vias in PCBs and interposers, realized with voxel sizes from 10  $\mu\text{m}$  down to 800 nm have already been presented by us at last year's EPTC (see &). [C401]

#### "Reliability assessment of sintered nano-silver die attachment for power semiconductors"

For decades soldering has been the technology of choice in die bonding. However, due to worldwide health protection regulations, the most common solder alloys, which contain lead, have been banned. Furthermore, standard solders cannot fulfil the reliability requirements of future power electronic devices. New interconnection technologies have to be developed. One of them is pressure sintering ( $p=30..50$  MPa) of silver flakes below 300°C. It forms a strong, highly electrically and thermally conductive bond. In order to lower the level of pressure, silver nanoparticles can be used. Shear tests have shown that even 5 s of sintering, a temperature of 225°C, or a pressure as low as 2 MPa is sufficient to generate bonds comparable to solder and high pressure sinter joints if the remaining parameters ( $p$ ,  $t$  and  $T$ , respectively) are set correctly. However, strength is only a necessary criterion as aging comes into play. Therefore, reliability tests using thermal cycling and power cycling were run. These returned superior reliability of the sintered samples. 160 million of the power cycles between +45 and +175°C run in this work can be extrapolated using a Coffin-Manson model. Solder joints failed at about 40,000 cycles. [C402]

#### "Preparation of Uniform and Stable Organic Phase-Change Nano-fluid of Paraffin and Nano-aluminum for Thermal Storage"

As a kind of middle-temperature PCM (Phase Change Material), paraffin is perfect except for its poor thermal conductivity. Nano-aluminum, which has high thermal conductivity and good compatibility, was added into paraffin to improve its thermal conductivity. Surface modified technology was adopted and dispersant was used to prepare uniform and stable organic phase-change nano-fluid of paraffin and nano-aluminum. The nano-fluid with 0.5%wt SDBS as dispersant and with 9%wt nano-aluminum which surface had been modified had good dispersion and stabilization. The reasons of good dispersion and stabilization of the prepared nano-fluid were analyzed. It was the effects of surface modification that help to disperse the nano-particles and the effects of electrostatic tranquilization of SDBS that help to stabilize the nano-fluid. [C403]

#### "Vibrometer's Measurement Technology in High Temperature"

The high-speed flight's body surface's temperature may surpass 1000°C by the influence of air friction, therefore the thermostable measuring technique is one of key technologies in this kind of weapon experiments. In missile's ground experiment environment, the acceleration instrument all around uses the high temperature spotlight illumination to elevate temperature, this temperature may reach 1400°C. In order to surveys vibration signal on shell body surface under this high temperature, we needs to carry on thermal protection to the ordinary accelerometers. This paper introduced one kind of accelerometers high temperature-surveys technology, designed the thermal protection and refrigerate the structural, realizes oscillation measuring technique in high temperature, and through the ANSYS simulation and related experimental verification structure reliability. [C404]

#### "Ultra-scaled III-V Quantum-Well Field Effect Transistor for THz and post-Si-CMOS digital applications"

Recently, III-V quantum-well field effect (QWFET) Transistors have emerged as the most potential technology of choice for future Tera-Hz and next generation high-speed, lowvoltage logic applications beyond Si-CMOS technology. In fact, the excellent RF-performance has been demonstrated using InAlAs/InxGa1-xAs HEMTs on InP substrate. This paper presents the fabrication of the nano-scale high performance InxGa1-xAs-channel QWFETs and the evaluation of QWFETs for RF and low-power logic applications. Superior drain-source current density of 1015 mA/mm was achieved with an extremely high transconductance ( $g_m$ ) of 1900 mS/mm when the drain voltage (VDs) was biased at 0.5 V, it indicated that the In-rich InxGa1-xAs-channel QWFETs can be biased at a low supply voltage to reduce overall dc power consumption, while maintaining relatively high current density and  $g_m$ . For the logic characteristics, a low calculated gate delay of 0.54 psec was also achieved at 0.5



V drain bias due to the superior transport properties of the InAs channel. The drain induced barrier lowering (DIBL) and subthreshold slope (SS) were calculated to be 200 mV/V and 115 mV/dec, respectively. [C405]

### "Nano-structured large area electronics"

Summary form only given. The evolution in materials and process fabrication technologies is posing new challenges and application areas in large area electronics. A driving force in this evolution is thin film Si technology. Interest in Si thin film technology stems from a variety of desired technological features including low temperature manufacturing with few constraints on the substrate size, material, or topology. More recently, the extension of this technology to flexible plastic substrates has received considerable attention. Interests on plastic is being driven by the need for lightweight, unbreakable, and foldable screens for a plethora of new application areas related to the human-machine interface. While the need for this technology is overwhelming, the material is intrinsically limited in speed and stability, as compared to poly-Si or crystalline-Si. Hence, the quest for improved material structure at low deposition temperatures and improved system stability through use of circuit compensation techniques. This talk will review these challenges. Specifically, it examines growth conditions for realization of nano-crystalline Si along with design considerations pertinent to thin film circuits whose integration requires non-conventional design solutions to deal with the high instability. The family of devices and circuits presented here are applicable for a new generation of displays based on the organic light emitting diode. [C406]

### "Prospective for thermal energy harvesting in mobile computing systems"

Micro and Nano Electro Mechanical Systems (MEMS/NEMS) are disruptive interdisciplinary technologies that can manifest in multiple components in portable systems. Such technologies will play an important role in enabling smaller, more efficient, and faster mobile computing systems. Integrated Radio Frequency MEMS components are front-runners as alternative technologies to replace bulky off chip RF time keeping and frequency control components. MEMS switches co-fabricated with MEMS resonators and filters would reduce the complexity of current mobile platform antennas and extend the reconfigurability of these antennas to operate on a wider range of frequency bands. Energy harvesting is an emerging area where MEMS is expected to play a disruptive role in extending the operational time for small Form-Factor (FF) hand held devices. This paper presents the current mobile platform usage and suggested areas for MEMS/NEMS energy harvesting with focus on thermal energy harvesting environment in mobile devices. [C407]

### "Metal lift failure modes during fine pitch wire bonding low-k devices with Bond Over Active (BOA) design"

The size of IC device has been reduced resulting from the advancement of silicon fabrication technology in reducing the transistor gate length. For wire bonded devices with high IO count, the final die size is principally determined by the size and layout configuration of the IO cells and wire bond pads. Traditional design of wire bond pads would consist of a top metal layer with no active circuitry or back-end-of-line (BEOL) interconnecting routing underneath the metal bond pad. The keep-out zone underneath the wire bond pad is typically filled in with back-end-of-line tiling for fabrication planarity and/or structural robustness. As BEOL metal layers increases, this keep-out zone represents white space on silicon and becomes a huge penalty against die size reduction. Bond Over Active (BOA) technology enables the use of the keep-out zone and moves active devices, ESD circuitry, power and ground busses underneath the wire bond pads. Finer pitch wire bonding capability for smaller wire bond pad dimensions and tighter pitches further enables IO cell resizing and optimization for die size reduction. The combination of BOA technology, fine pitch wire bonding and low-k/copper technology have thus become a new development scope for wire bonding technology development works. Several new metal lift failure modes were reported during wire bonding or during wire bonding destructive tests such as ball shear and wire pull. The Aluminum Cap Lift failure mode denotes the delamination between the copper bond pad and the Tantalum barrier layer of the aluminum cap bonding pad region. The Copper Metal Lift failure mode describes the delamination between BEOL dielectric layer of FSG (fluorine-doped silicon glass) and the Tantalum barrier layer in the BEOL stacks. The specific delamination interfaces for Aluminum Cap Lift and Copper Metal Lift failures were determined by several failure analysis techniques. Some of these techniques are standard failure analysis tools such as TEM (Transmission Electron Microscope) and Auger depth profiling, and others are more dedicated such as nano-indentation. The last failure mode called Tilted Metal Lift was also observed during wire pull test as the ball bond diameter was reduced for fine pitch wire bonding. Multiple layers are pulled off and the break is deeper in the area closer to the die edge than to the die core region. Root cause analysis for each failure mode and its corresponding corrective actions will be disclosed in this paper. [C408]

### "Logic Gate Implementations for Quantum Dot Cellular Automata"

Quantum dot cellular automata (QCA) is a novel and potentially advanced technology for implementing



computing architecture at nano scale. QCA is a promising successor for CMOS transistor technology, while allowing the implementation of logic circuits using quantum devices, such as quantum dot or single domain nano magnets, a new set of tools must be developed to assist the design and implementation process. In this work we describe the majority gate, fan out, inversion chain, clocking half adder, full adder and their computation. [C409]

#### **"Advanced NEMS-based power management for 3D Stacked Integrated Circuits"**

In this paper we introduce a novel power management architecture for 3D Through Silicon Vias based integration technology. Our approach relies on the synergy of two new technological developments as follows: (i) we utilize a Nano-ElectroMechanical (NEM) device, the Suspended Gate FET (SG-FET), as sleep transistor; and (ii) we make use of the 3D potential by placing the sleep transistor (the entire power management infrastructure) on a dedicated tier of the 3D stacked Integrated Circuit. Due to the extreme low leakage current of the SG-FET our proposal results in 2 orders of magnitude static power reduction, when compared with equivalent counterparts based on traditional CMOS devices. The SG-FET power switch requires about 44 more area when compared to bulk CMOS, however, due to the 3D integration which allows for heterogeneous dies to be stacked, the power gating devices can be placed to a low cost dedicated layer, which also results in a substantial IR-drop reduction with minimum impact on leakage. [C410]

#### **"Influence of aperiodicity of nanoscale structures on the resistance"**

Nano-scale devices are considered as an aperiodic structure based on a crystalline material. For the proposed approach the approach for quantum conductivity of materials is grounded, when the change in resistance of semiconductor working layers is determined by the concentration of free carriers generated by periodic and aperiodic power budget. [C411]

#### **"Major achievements of the NANOPACK project"**

NANOPACK-Nano Packaging Technology for Interconnect and Heat Dissipation- is a European large-scale integrating project aiming at the development of new technologies and materials for low thermal resistance interfaces and electrical interconnects, by exploring the capabilities offered by nanotechnologies such as carbon nanotubes, nanoparticles and nano-structured surfaces, and by using different enhancing contact formation mechanisms, compatible with high volume manufacturing technologies. Major achievements of the project will be presented, in particular in the fields of low resistance thermal interface materials, their modeling and their characterization. [C412]

#### **"Surface magnetostatic wave filters with magnetron sputtered nanoscale films of yttrium iron garnet"**

Results of operation of MSSW filters with nano-scale films of yttrium iron garnet are presented. The peculiarities of filter characteristics are discussed. Nanoscale films in MSSW filter are used for broadening of input signal dynamical range due to the realization of single domain state in YIG films even at low magnetic field 1E. The use of nanoscale YIG films in MSSW filters allows increasing of frequency selective characteristics of these devices in the decimeter microwave range. MSSW filters with films grown by the magnetron sputtering have low insert losses in comparison with films grown by LPE. [C413]

#### **"Spin-torque magnetic nano-structures as microwave sources"**

In experimental microwave sources based on spin-torque magnetic nano-structures (MNS) the power is extracted as oscillation of the device magnetoresistance (MR). The goal of our work is to evaluate the magnitude of the microwave power that can be extracted from a MNS through the oscillating dipolar fields when the MNS is coupled to different microwave systems, and to compare this power with the power that can be extracted through the traditional MR mechanism. We demonstrate that, although for a single MNS the MR mechanism is much more efficient than the direct dipolar electromagnetic emission, the latter mechanism can have a significant advantage in the case of a sufficiently large array of synchronized MNS placed in a microwave resonator. [C414]

#### **"Preparation and antibacterial property evaluation of TiO<sub>2</sub> /nature rubber nanocomposites"**

Nano-TiO<sub>2</sub> was prepared by sol-gel technology. The results displayed that the particle size of modified TiO<sub>2</sub> was less than 20 nm, and that of the unmodified TiO<sub>2</sub> was about 30nm; XRD analysis confirmed the TiO<sub>2</sub> made from sol-gel method was anatase type. TiO<sub>2</sub>/NR nanocomposites were found to possess excellent antibacterial and antifungal effects. [C415]



### "Leakage behavior of underlap FinFET structure: A simulation study"

Bulk MOSFET is reaching to its physical limit with the advancement of technology. The key factor which influences the performance of bulk MOSFET in nano regime is the gate oxide thickness. In this work an attempt has been made to analyze the underlap FinFET structure using 2D simulation. ITRS 2009 high performance (HP) updates for the year of 2015 is used in this work. Study of n-type underlap FinFET structure is carried out to analyze the effects of metal gate with high-k dielectric. Use of high-k dielectrics with metal gate at a given EOT can improve the gate leakage current without harming the device performance. Underlap structure provides an improvement in the off-state leakage current than the overlap structure. Effects of gate workfunction variation on the performance of underlap FinFET structure is also studied in this paper. [C416]

### "Self-heating effect and characteristic variability of gate-all-around silicon nanowire transistors for highly-scaled CMOS technology (invited)"

This paper discusses self-heating effect and variability behavior of GAA SNWTs. Due to the 1-D nature of nanowire and increased phononboundary scattering in GAA structure, the selfheating effect in SNWTs based on bulk substrate is comparable or even a little bit worse than SOI devices, which may limit the ultimate performance of SNWT-based circuits and thus special design consideration is expected. On the other hand, random variation has become a practical problem at nano-scale. The characteristic variability of SNWTs is experimentally extracted and studied in detail. And the impacts of nanowire LER, the diameter-dependent annealing enhanced nanowire SDE-RDF are discussed, as well as the variability impact on SNWT based SRAM cells. [C417]

### "A comparative study of CMOS & CNFET based current conveyor at 32nm technology node"

This paper presents for the first time the design and comparison of wide bandwidth high performance CMOS and CNFET realization of dual-output second generation current conveyor (CCII±) at 32nm technology node. Until this date, almost all design efforts of CCII± have been directed towards micron range, and the designing aspects at nm range still needs to be explored. Voltage and Current bandwidths, port resistances along with power consumption have been the parameters for comparison. Simulations have been carried out using HSPICE simulator at a reduced power supply of ±0.8V. [C418]

### "High performance optimized CNFET based current conveyor at 32nm technology node"

This paper presents the design of a wide bandwidth high performance CNFET realization of dual-output second generation current conveyor (CCII±) at 32nm technology node. HSPICE simulation shows that voltage and current bandwidths in excess of 22GHz are obtained, thus making the module quite suitable for applications in the microwave range of frequencies. Besides, the circuit is able to operate at reduced power supply of ±0.9V and presents desirable port resistances. The variation of bandwidth and port resistances against number of CNT in the channel has also been investigated. [C419]

### "Preface"

This book and CD contain the papers presented at the 12th Baltic Electronics Conference (BEC2010), which was held in Tallinn, Estonia in 4-6. October 2010. This time the opening plenary session was held at the Tallinn University of Technology and the conference sessions and the final plenary session at the conference centre Swisshotel Tallinn. The Department of Electronics together with the Department of Computer Engineering of Tallinn University of Technology (TUT) organized the BEC2010. Support was given by the TUT Technomedicum and from the Departments of Computer Science and Electrical Drives and Power Electronics. The IEEE Circuits and Systems branch gave the technical sponsorship to the conference. The Competence Centre in Electronics, Info- and Communication Technologies ELIKO and the Centre of Excellence in Integrated Electronics Systems and Biomedical Engineering CEBE supported our event from the side of industry and the basic research as well. In response to the call for papers the International Program Committee received about 100 papers from 20 countries, mostly from Estonia, Latvia, Lithuania, Finland, and Germany, but even from USA, Egypt, Korea and Iran. The Conference program features 10 invited papers and 79 papers for oral presentation. The whole conference is dedicated to the 240th anniversary of the discoverer of thermoelectric effect by the Estonian-German physicist Thomas Johann Seebeck. The opening plenary session involves my speech about close to 25 years history of BEC conference series and very exhaustive study about the Seebeck's biography, presented by professor emeritus Enn Velmre. On the opening plenary session also the topics like SOC design for wireless communications, reliable communication in intermittently-connected networks, and about beyond CMOS era and nano-solutions has been discussed. The closing plenary session covers the topics of synthesis of circuits and systems from hierarchical and parallel specifications, future--computer system design challenges and convergence of design, and fabrication technologies as a key enabler for smart systems integration, cooperative



converters in power electronic systems, and application of the principle of reciprocity to impedance tomography and other problems in bio-electromagnetism. [C420]

### "Methane Detection by MIM Sensor Devices Based on Nano ZnO Thin Films Obtained by Sol-Gel and by Anodization: A Comparative Study"

Amongst various gas sensor structures developed so far probably the least investigated one is the Metal-(Active) Insulator-Metal or (MIM) structure. It has been reported that the vertical electron transport mechanism of this structure offers high response with fast response and recovery for gases like H<sub>2</sub> and methane compared to the conventional planar configuration. In this paper we report on the comparative performances of two kinds of MIM sensors based on nanocrystalline-nanoporous ZnO as the active sensing layer derived by sol-gel and by the UV assisted electrochemical anodization method respectively. The sensor structures based on Pd-Ag (26%)/ZnO/Zn were investigated in presence of five methane concentrations (0.01, 0.05, 0.1, 0.5 and 1.0%) and in the temperature range 150°C to 300°C. The electrochemically developed ZnO showed superior performance in terms of operating temperature, response magnitude, response time and recovery time. Moreover, it showed response to much lower concentrations (like 0.01% and 0.05 %) of methane that could not be detected by the sol-gel derived sensor. The possible reason for the superiority of the electrochemically grown ZnO compared to the sol-gel derived one was shown to be the significantly lower grain size and appreciably high porosity. But, in spite of its promising performance the electrochemically developed MIM sensor has no selection of the substrate and so it is not compatible to the standard IC technology. It leads to its restricted use to develop only the stand-alone sensor devices. On the other hand, sol-gel derived MIM device is based on the Si substrate. So, it is IC compatible and is suitable for the integrated sensor platform. [C421]

### "Recognition of Chemical Warfare Agents Based on Nanosensor Array and Probabilistic Neural Network"

Nanosensor is a new technology of highly integrating between nanotechnology and chemical sensors. For the advantage of good stability, high sensitivity, strong anti-interference and so on, it has good application foreground in the latest filed of gaseous sample detection. In this work, a novel analytical system based on nanosensor array and probabilistic neural network (PNN) was developed to detect chemical warfare agents such as sarin and mustard gas. The array consisted of four quartz crystal microbalance with a fundamental frequency at 10MHz. To improve the selectivity and sensitivity, four nano-membrane materials such as nano-zeolite modified with copper ion (CuZSM-5), modified carbon nano-tubes (CNT), hydrogen bond acidic fluorinated polymethylsiloxane (mTFPS) and polyepichloro-hydrin (PECH) were synthesized and selected as the Sensitive membrane material of chemical warfare agents. Then, a nanosensor array with these nano-film materials was developed. Combined with pattern recognition methods, a qualitative and quantitative identifying mode has been set up. The signals obtained from the array were analyzed with PNN to identify the toxic gases. The success rate of identification was 96.15%. The study integrate a variety of modern high-tech, which has novel methods and a high level of technology, an independent innovation research has been made for China's anti-chemical warfare detector technology, opening up a new generation of chemical detectors and equipment developed in new field. [C422]

### "An Adiabatic Single-Phase MTCMOS Scheme for Leakage Reduction in Nano-Scale CMOS Processes"

With the rapid scaling down of CMOS manufacturing technology, the reduction in leakage consumption has become an important concern in low power and high performance applications for nano-scale CMOS processes. This paper presents a MTCMOS (multi-threshold CMOS) power-gating scheme for single-phase adiabatic circuits, which minimizes leakage dissipations during sleep mode. The 8-bit full adder based on Improved CAL (Clocked Adiabatic Logic) circuits with the MTCMOS scheme is used to verify its leakage reduction. All circuits are simulated using 90nm Nano-CMOS technology with 0.15V low threshold voltage and 0.35V high threshold voltage, and 45nm Nano-CMOS technology with 0.12V low threshold voltage and 0.28V high threshold voltage. The simulations show leakage consumption can greatly be reduced by using the proposed MTCMOS power-gating technique compared with the conventional power-gating one. [C423]

### "Integrated Micro/Nano Structures as Electrodes in Biosensors"

This paper presents a new process to develop integrated micro/nano 3D structures as well as usage of these structures as electrodes in biosensors. It also discusses the effect of anchoring molecules on the functionalization of the electrodes and their sensing performance in glucose detection. Results show that using electrodes with 3D structures improves the sensitivity of glucose sensors and that entrapping enzyme near the electrode surface within a porous polymer layer provides an efficient means for electron transfer. [C424]



### "Enlarged Sample Holder for Optical AFM Imaging: Millimeter Scanning with High Resolution"

We developed a home-made Sample-Holder Unit used for 2D nano-positioning with millimeter traveling ranges. For each displacement axis, the system includes a long range traveling stage and a piezoelectric actuator for accurate positioning. Specific electronics is integrated according to metrological considerations, enhancing the repeatability performances. The aim of this work is to demonstrate that near-field microscopy at the scale of a chip is possible. We chose here to characterize highly integrated optical structures. For this purpose, the sample-holder is integrated into an Atomic Force Microscope in order to perform optical imaging. To demonstrate the overall performances, a millimeter scale optical images have been realized. [C425]

### "Microwave planar antennas for telecommunication devices based on magnetic nano-structures (spin-torque nano-oscillators)"

Theoretical investigation of possible application of microwave planar antennas for the development of telecommunication devices based on magnetic nano-structures (MNS) (spin-torque nano-oscillators) is presented. It is shown that coplanar antennas have some advantages in comparison with other types of antennas. The performance of the antennas in a frequency range 1-5 GHz is estimated, and it is shown that considered antennas have sufficiently good parameters and can be used for the development of telecommunication devices based on MNS. [C426]

### "Surface Modified Nanoporous Materials for Hydrogen Sensing"

Nanoporous silicon and nanoporous ZnO were prepared by the electrochemical anodization of crystalline Si and Zn substrate. To passivate the defect states (arise due to the nano structure of the PS and ZnO thin film and introduce a barrier for the current conduction) and to improve the gas sensitivity the porous silicon and nano crystalline ZnO surfaces were modified by PdCl<sub>2</sub> solution. The Pd modified sensors having Pd-Ag (26%)/PS/Si/Al (MIS) and Pd-Ag (26%)/ZnO/Zn (MIM) device structures were investigated in different hydrogen concentrations (0.01, 0.05, 0.1, 0.5 and 1.0%) regarding optimum biasing voltage and temperature. Both the sensor showed superior performance in terms of operating temperature, response magnitude, response time and recovery time. [C427]

### "Micro Device for Mechanical Evaluation of Axi-symmetric Nanometric Samples: A Feasibility Study"

A device is introduced which are able to perform tension tests on nano materials, which works on the basis of a differential thermal dilatation of two of its components. This difference in dilatation is enough large to put the device in operation when it is heating inside a Transmission Electron Microscope and stretching axi-symmetric nano samples until breaking. The feasibility to produce and utilize such device, for nano-mechanical tests inside a TEM, has been demonstrated. This device present the following advantages. a) It works without using an internal electric current, which avoids parasite currents improving the quality of the TEM image. b) It is unnecessary to modify the original design of commercial equipments, because its geometry fits perfectly the standard sizes of microscope holders. c) Its cost may be very low making it practically disposable at each test. [C428]

### "Size and temperature effects on the resistance of copper and carbon nanotubes nano-interconnects"

The electrical performances of nano-interconnects are affected by temperature and size, which may seriously limit the current density and the reliability. This paper introduces such effects in the modelling of the electrical resistance of nano-interconnects, either made by copper and carbon-nanotubes. A simple and accurate semi-analytical model is proposed to describe the impact of size and temperature changes on the resistance of carbon nanotube interconnects. Case-studies are carried out with reference to 22nm technology node applications. [C429]

### "New method for head-up display realization by mean of Chip On Board and Aerosol Jet process"

A new method to fabricate transparent head-up display on glass has been developed. The method exploits the integration of the Aerosol Jet® Process in the Chip On Board technology. The Aerosol Jet® Process is an additive process, which allows the deposition of a wide variety of materials onto a wide variety of substrates without conventional masks or thin-film equipment, but driven by a CAD file (see, e.g.). The process uses aerodynamic focusing to precisely and accurately deposit nano dispersions, so called "functional inks". The process has been used for the printing of thin conductive layout on glass with Ag-nanoparticle based conductive



inks. After layout deposition, the chip-LED has been mounted on the glass by means of flip chip process exploiting micro-stamping technique. The developed displays have a luminance higher than 10000 cd/m<sup>2</sup> and the visibility through the glass substrate fulfills requirements to guarantee the application also on windshield in automotive field. [C430]

#### "Water diffusion in micro- and nano-particle filled encapsulants"

Polymer materials mainly epoxy resins are widely used in microelectronics packaging. They are established in printed circuit board manufacturing, for adhesives as die attach glues or for encapsulants as molding compounds, glob tops or underfill materials. Low cost and mass production capabilities are the main advantages of these materials. But like all polymers they cannot provide a hermetical sealing due to their permeability properties. The susceptibility to water diffusion through the polymer and along the interfaces is a drawback for polymer materials in general, as water inside a microelectronic package might lead to softening of the material and to a decreasing adhesive strength and resulting delaminations close to solder bumps or wire bonds reducing package reliability by decreasing the package structural integrity. During package reflow, the incorporated humidity might lead to popcorning, i.e. abrupt evaporation of humidity during reflow soldering. This effect is one major problem during plastic package assembly. The introduction of high temperature lead-free soldering processes has even increased this issue. Therefore, plastic packaging materials with enhanced humidity resistance would increase package reliability during assembly and lifetime ideally without cost increase and with no changes in processing. As filler particles have an important influence on the final material properties of microelectronic encapsulants, they are well suited for material modifications. Typically micro-sized silica particles are incorporated into the polymer matrix as the thermo-mechanical properties could be well adapted to reliable packaging demands. However, there are a lot of nano- and micro-sized filler particles with potential to enhance the humidity barrier properties of encapsulants. Working principles of these particles may range from large surface impact of nano-particles, barrier functionality due to stacked layer formation (nano-clays), highly hydrophobic particle surface and molecular water catcher function. Micro- and nano-sized SiO<sub>2</sub>, bentonite, zeolites, Al<sub>2</sub>O<sub>3</sub>, carbon black and carbon nano tubes have been selected for a systematic study. To evaluate the potential of such additives concerning moisture resistance particles are mixed with a microelectronic grade epoxy resin. Formulations are characterized regarding their influence on humidity diffusion, absorption and desorption behavior as well as their influence on other material properties as reaction kinetics and viscosity. Different methods for characterization of the diffusion properties have been developed and applied for material analysis. The pros and cons of simple weight measuring for absorption testing, sorption analysis and encapsulated humidity sensors are presented and discussed along testing results with formulations with the different filler particles. In summary this paper describes the potential of different nano- and micro-sized particles as additives for plastic packaging materials for enhanced humidity barrier enhancement within microelectronic packages as well testing methods for material characterization concerning their humidity diffusion and absorption properties. This topic is gaining increased importance when considering the trend towards System in Package, where a multitude of components is encapsulated to form one miniaturized SiP that incorporates a large number of different material interfaces and interconnects. These SiPs need to be protected from the environment by encapsulants layers with ever decreasing thickness and thus increased moisture barrier properties. [C431]

#### "New packaging concept for ultra high precision 3D tactile probes for CMM applications"

True three dimensional (3D) measurements of micro and nano structures are becoming vital due to the increase in micro mechanical and optical devices used in today's technologies. Measurements with resolutions less than 100 nm in industry and less than 20 nm in national metrology institutes are desired today. In order to achieve this goal we have developed an ultra high precision tactile probe for micro/nano-coordinate measuring machines (CMMs) [1]. The first stage of the development of the silicon based CMM micro probe has been reported earlier [2, 3]. The probe consists of a compliant silicon micro structure with piezo-resistive elements as readout technique. This paper reports on the optimization of the packaging of the silicon sensing element. Starting with the initial design of the packaging where the chip was contacted and mounted directly through probing pins a first optimization is presented where the chip is mounted to a printed circuit board (PCB) carrier and contacted electrically through wire bonding. By replacing the PCB with a ceramic substrate the performance of the micro probe could be enhanced further. Measuring results are presented demonstrating the progress of this optimization process. [C432]

#### "Application of multi-criteria optimization algorithms to numerical material extraction of thin layers through nanoindentation technique"

Current developments and trends in microelectronics are focused on thin layers and novel materials. This leads to application of different test and measurement methods, which are capable to measure basic mechanical properties of such materials on micro-scale and nano-scale. The presented paper focuses on application of the



nanindentation technique in order to extract the basic elastic and elasto-plastic mechanical properties through numerical approaches. In order to extract the elasto-plastic material data of the investigated thin layers the numerical process was designed. First of all, the nanoindentation process was elaborated in FEM Abaqus software. Then, the results were compared to the measurements and processed by the numerical optimization algorithms. [C433]

#### "Reliability of Ag ink jet printed traces on polyimide substrate"

Printable electronics is a new emerging technology with capabilities of producing high volumes, low price and flexible electronic devices. Printing techniques using nano-size material particles at low temperatures can revolutionize the electronics industry in coming years. However, a number of questions, mainly related reliability of such devices, are still pending. Reliability of electronic devices can be accessed through the use of accelerated life testing and degradation analysis. In this sense, conductive traces printed through in inkjet method on flexible substrates can have its reliability estimated. Such analysis provides valuable information in order to allow the mass production of devices which utilizes this technology. In this paper, metal nanoparticles based ink was printed on flexible polyimide substrates. After curing, the microstructure was analyzed through scanning electron microscope (SEM) and trough profilometer. Printed traces underwent two different environmental tests: 85/85 test (85°C and RH 85%) and Thermal Cycling (-40°C to 125°C with a dwell time of 30 min and a ramp time of 1h). The number of conductive layers printed was modified and these samples were grouped. A variation of 20% in the trace resistance was considered as a failure. Curves of reliability versus time were obtained for the different analyzed groups. It was possible to observe that samples with 1 and 5 layers have similar reliability in the 85/85 tests. Moreover, it was not possible to observe delamination in the samples submitted to cycling tests. Probably, the porous traces microstructure has a key influence in the reliability. [C434]

#### "Au-Sn fluxless SLID bonding: Effect of bonding temperature for stability at high temperature, above 400 °C"

Fluxless SLID (Solid-Liquid InterDiffusion) bonding based on Au and Sn is presented, using two different processes, and bonding temperatures in the range 300-350°C. The decomposition of the bond was tested by applying shear force while heating the samples. No bond delamination was observed for temperatures up to 350-400°C, with 95% of the tested samples surviving 400°C without bond delamination. This is more than 100°C higher than the melting temperature of the commonly used eutectic Au-Sn bond (80 wt% Au, melting at 278°C). The Au-Sn system is particularly interesting since it is oxidation resistant, allowing fluxless bonding. With the SLID process, the metal system is applicable for true high-temperature applications. The bonded samples had electroplated Au-Sn layers (Process A), or were made by sandwiching a Au-Sn eutectic preform between Au layers (Process B). In both cases, the overall composition was 7 wt% Sn (11 at% Sn), thus being a surplus of Au relative to the Au<sub>5</sub>Sn phase. This phase has a melting point up to 519°C, and is the desired bonding phase for a Au-Sn SLID process to tolerate high temperatures after bonding. Microscopy and EDS analysis of cross-sections identified indeed Au<sub>5</sub>Sn as the only bonding phase (in addition to Au). It is remarkable that also samples bonded with as low temperature as 300°C (below the melting point of Sn-rich intermetallics) show this structure and the corresponding high-temperature stability. [C435]

#### "Spherical polymer particles in isotropic conductive adhesives a study on rheology and mechanical aspects"

Isotropic conductive adhesive (ICA) filled with metal coated polymer spheres has been studied as a novel approach to increase the flexibility, and hence the reliability of the adhesive compared to traditional metal filled ICAs. In this paper, we have investigated the rheological properties of the novel ICA to evaluate its applicability in practical use. The current work also involves the investigation of the mechanical properties including shear strength of the novel ICA. Spherical polymer particles (SPP) of sizes 116 µm and 130 µm were investigated in the present study. The results show minor differences in the rheological properties and the adhesion strength for adhesives filled with particles in different sizes. Filling SPP into the adhesive matrix increases the viscosity of the system monotonically and continuously, in excellent accordance with model systems previously reported in the literature. Furthermore, the novel ICA exhibits high mechanical shear strength, being comparable to the traditional solder joint technology and twice higher than the traditional metal filled ICA. [C436]

#### "Fluxless wafer-level Cu-Sn bonding for micro- and nanosystems packaging"

For wafers with integrated and released sensitive micro- and nanosystems a fluxless wafer-level hermetic packaging solution is required. By using a 1.5 µm thick Sn layer as oxidation barrier for 5.0 µm thick Cu bond frames, the surface does not require pre-cleaning or use of any flux agent prior to, or during Cu-Sn bonding. With a tailored temperature and pressure bonding profile, the amount of Sn squeeze-out is reduced. Both for



Cu-Sn bonds performed with new and aged electroplated films the measured shear strength is above 30 MPa. Further temperature cycling of bonded dies does not result in any reduction in bonding yield or shear strength.

[C437]

#### "Influence of moisture on humidity sensitive material parameters of polymers used in microelectronic applications"

Most used polymers show a visco-elastic behaviour. The significant change of the material properties is a function of time and temperature, and needs to be taken into consideration. When exposed to humid environments, epoxy resins can absorb water up to a 10 weight %, depending on the chemical nature and structure, stress state, exposure time, water concentration and temperature. The use of temperature and time dependent material parameters is state-of-the-art in microelectronic packaging. This paper presents various modified measurement methods for analysis of the effect of moisture of thermo-mechanical properties of MEMS-relevant polymer systems. In the Micro Materials Center's lab, an advanced measurement method was developed-which modified DMA multifrequency and hygroscopic swell analysis for the determination of moisture-dependent parameters for micro and nano scale samples. The time-moisture superposition principle has been introduced for some polymers where a humidity shift factor is used along the frequency axis at constant temperature. The relationship between the humidity shift factor and the equilibrium water content is analogically described by the WLF (Williams-Landel-Ferry)-type equation on the time-temperature-superposition. Due to moisture absorption, the glass transition temperature was reduced for fully saturated samples, and visco-elastic properties which are influenced by moisture prefer the state of entropy elasticity already to lower temperature significantly. Furthermore, diffusion in unfilled epoxies follows the conventional Fickian diffusion of polymers.

[C438]

#### "Surface modification and wettability of silicone PDMS film"

In this work, silicone PDMS (polydimethylsiloxane) films were deposited on 100 mm silicon wafer by spin-coating technique and its surface is modified by plasma CHF<sub>3</sub> and O<sub>2</sub> treatment in a vacuum chamber, respectively. Wettable surface is obtained through subsequent plasma O<sub>2</sub> treatment. Scanning Electron Microscope (SEM) and Energy dispersive x-ray spectroscopy (EDX) indicate that the plasma CHF<sub>3</sub> treatment induces the formation of island-like nano-structures. The chemical composition of the island-like nano-structures is silicon-rich in near surface region. The surface roughness increases from 9 nm to 230 nm as plasma treatment time increases from 0 to 40 minutes. The wettability of the PDMS surface is strongly dependent on its roughness and the time of plasma O<sub>2</sub> treatment. A typical contact angle of 5 µL water droplet after aging 25 hours at room temperature is about 35 ° on the PDMS surface with roughness 230 nm. [C439]

#### "Investigation of properties of the SAC solder paste with the silver nanoparticle and carbon nanotube additives and the nano solder joints"

Several nanomaterials like silver nanoparticles and carbon nanotubes were obtained and their size and microstructure were investigated. The silver nanoparticles were characterized by different grain size (from below 10 nm up to 200 nm) and microstructure. The diameter of the carbon nanotubes was 5 ч 50 nm and the length 0.5 ч 10 µm (max 100 µm). These nanomaterials were mixed with our own prepared SAC solder paste. Several technological properties of the "nano" solder pastes were investigated like spreading, wetting, solder ball and slump. The "nano" solder pastes were used for soldering on Cu substrates. Some mechanical properties of the "nano" solder joints were also investigated. Microstructure of the "nano" solder joints were carried out using SEM equipped with energy dispersive X-ray spectroscopy (EDS) system. Relation between properties of the solder joints with nano particles and their microstructure was analyzed. [C440]

#### "Nano-slit photonic crystal nanolaser with mode localization in air"

We fabricated and evaluated GaInAsP photonic crystal nanolaser with a 30-nm-wide nano-slit structure. The results ensure strong modal localization in the nano-slit, which can enhance interaction with gases, liquids, bio-molecules. [C441]

#### "Microstructure and mechanical properties of laser ablation cleaned NiP platings for aluminum wire bonding"

Aluminum wire bonding to nickel surfaces is often used in automotive applications. For assurance of a high quality contact a clean substrate without any contaminants is required. In this study lead frame structures consisting of matte nickel, bright nickel and electrolytic deposited NiP (up to 0.5 µm thickness) were used for Aluminum wire bonding. The lead frame was partially plated with tin at the connector end (opposite from the wire



bonding surface). During the tin plating process an unintentional tin layer of about 10-20 nm was deposited onto the NiP wire bonding surface. Laser ablation was used to clean the NiP areas before wire bonding. This paper presents microstructural investigations of the NiP/Sn platings with and without laser ablation. Using FIB/SEM/TEM the thickness and crystalline structure of NiP layer was analyzed. The phosphorous concentration gradient across the depth of the NiP layer was investigated by nano-spot EDX. Using nanoindentation measurements, the microhardness of the laser etched and non-laser etched areas was determined and correlated to the microstructural phenomena. The investigations show that not only does the laser treatment remove the tin contamination but it also removes the P-rich surface film. The lasered samples also showed a very coarse grain structure close to the Ni film which indicates a temperature-induced recrystallization effect. These results correlate with the mechanical investigations: At a depth of 50 nm to 200 nm significant lower indentation hardness was measured in the lasered specimen compared to the non-lasered specimen as detected by CSM nanoindentation measurements as well as standard nanoindentation measurements. [C442]

#### **"Nano materials for microelectronic packaging"**

This paper addresses the state-of-the-art nano science and technology regarding next generation high density microelectronics packaging applications, including carbon nanotubes (CNTs) for electrical/thermal interface materials, nano alloys for low temperature surface mount assembly and molecular wires for electrical interconnects. [C443]

#### **"Investigation of nano-patterned PZT thin films by piezoresponse force microscopy"**

In this work, we describe an alternative lithography method for the fabrication of regular well-defined Pb(Zr,Ti)O<sub>3</sub>(PZT) nanodot arrays and the investigation of the local polarization and hysteresis properties of nano-patterned ferroelectric films. PZT films were produced by multi-target sputtering and patterned by nanosphere lithography. Therefore, a monolayer of well-ordered latex beads was assembled in a hexagonally close-packed array on a liquid-gas interface and deposited onto the PZT films. Both mask and film were then etched in a two-step process. By the first step, the size of the spheres was adjusted by low-pressure plasma etching, while secondly the PZT film was structured by ion-milling. The resulting nanostructures were investigated by piezoresponse force microscopy (PFM). The in-plane and out-of-plane polarization distribution was imaged. A reorganisation of the ferroelectric domains was observed depending on the structure and nanodot size. In addition, local hysteresis loops of single structures and domains were recorded. [C444]

#### **"New silver contact pastes from high pressure sintering to low pressure sintering"**

Heraeus has developed a novel concept for silver sinter pastes. The new concept uses micro scale silver particles combined with sinter additives. The novel pastes have high sinter activity and can be used in pressure free or less pressure bonding processes. The physical properties like shear strength at temperature above 200°C, electrical and thermal conductivity are outstanding compared to solder or silver adhesives. The new paste concept can reduce the pressure for the "Low Temperature Joining Technology" and is an alternative to nano-scaled silver pastes and can be potential lead free solutions for die attach applications. The paper describes the process route from high pressure to low pressure and limitations. [C445]

#### **"Influence of nano silver filler content on properties of ink-jet printed structures for microelectronics"**

The influence of nano silver filler content on properties of ink-jet printed structures for microelectronics were investigated. Samples were prepared by using ink with different nano silver filler content: 44%, 41% and 38%. The electrical measurements were performed during and after heating process. It was shown, that filler content does not have a strong influence on sintering time, but it changes the final resistivity of printed and sintered structures. The enhancement of sintering process by UV exposure was also investigated. Preliminary results are promising and the further study will be conducted. [C446]

#### **"Crack and damage evaluation in low-k BEoL stacks under assembly and CPI aspects"**

Miniaturization and increasing functional integration as the electronic industry drives push the development of feature sizes down to the nanometer range. Moreover, harsh operational conditions and new porous or nano-particle filled materials introduced on both chip and package level-low-k and ultra low-k materials in Back-end of line (BEoL) layers of advanced CMOS technologies, in particular-cause new challenges for reliability analysis and prediction. The authors show a combined numerical/experimental approach and results towards optimized fracture and fatigue resistance of those BEoL structures under manufacturing/package as well as chip package interaction (CPI) aspects by making use of bulk and interface fracture concepts, in multi-scale and multi-failure modeling approaches with several kinds of failure/fatigue phenomena. In addition, manufacturing induced residual stresses in the Back-end layer stack have an essential impact on damage behavior, because they



superpose functional and CPI loads. Their determination with a spatial resolution necessary for typical BEoL structure sizes is a critical issue. The nano-scale stress relief technique (fibDAC) makes use of tiny trenches placed with a focused ion beam (FIB) equipment at the position of stress measurement. Digital image correlation algorithms applied to SEM micrographs captured before and after ion milling allows to conclude on stresses released. Residual stresses can be computed with the help of appropriate, adjusted FEA models. [C447]

### "Green manufacturing technologies of CrTiAlN composite coatings as an alternative to chromium electroplating for piston rings"

As an alternative to chromium electroplating for piston rings, one green manufacturing technology of CrTiAlN composite coatings has been introduced in this paper. In addition the mechanical and tribological properties of CrTiAlN composite coatings have been compared with chromium electroplating and CrN films. During the deposition of CrTiAlN composite coatings, the three processing steps in deposition involved were plasma ion cleaning, buffer layer deposition, and multi-component layer deposition. During the final deposition step, nitrogen concentration was controlled at 0–50 %. The metallic ratio of Cr, Ti, and Al was varied by adjusting the target currents. The nano-indenter, energy dispersive X-ray(EDX), scanning electron microscopy and X-ray diffraction instrument were used to investigate the mechanical property and microstructure of the coatings. The experimental results showed that the optimized quaternary Cr-Ti-Al-N coating performs better than binary CrN as well as the conventional hard chromium plating in terms of hardness and wear resistance??which was suited to use under the high temperature condition of piston rings??and they can be proposed as an alternative to hard chromium platings. [C448]

### "Comparison of nano-structures of LiF coated on Steel and Ceramic substrates"

In this paper, the nano layers of LiF, were produced by using PVD method on Steel and Ceramic substrates and in vacuum conditions and vertical deposition angle. The produced nano-structures are studied by using AFM and XRD methods. The results of AFM analyses showed different morphology for both layers. The coated layer on Steel have smoother surface, than the Ceramic substrate. The noticeable point is the form of produced nano-grains that is global for steel substrate and needle like for ceramic substrate. XRD patterns didn't show any LiF peaks in 98 nm thickness and 220°C deposition temperature. [C449]

### "Covers"

The following topics are dealt with: aircraft structural part; NC machining; shear flow; AWSJ glass cutting; nano structured MgO; EHV transmission line fault; pattern recognition; crack detection; turbine blade; intelligent power system; intelligent energy system; centrifugal fan; volute casing; simulated rime ice accretion; RRRP manipulator; magnetic imaging; corrosion inhibition; diesel power generating unit; vaporizing fuel droplet; gas turbine combustor; GFRP composite; multipath routing mobile ad hoc network; traffic load estimation; digital photonic switch; four beam laser interference lithography; speaker identification; DC drive speed control; neural controller based series resonant converter; city bus information integrated control system; truck suspension system optimization; asymptotic trajectory tracking; flexible robotic arm vision system; spur gear; hydrodynamic torque effect; large size butterfly valve; touch mode MEMS capacitive pressure sensor; hydroelectricity production equipment; forestry harvesting machine connecting rod; workpiece surface roughness prediction; elastohydrodynamic line contact; subreflector feed angle calibration; doubly fed induction generator; railway wheel; acoustic vibration; MEMS based microstrip antenna; DLC coated ball bearing; electric motor mass unbalance; vibration monitoring analysis; port injection hydrogen fueled engine; wireless mobile sensor network; high-rise buildings structural vibration; perforated circular cylinder; and single chip white light-emitting InGaN/GaN diode. [C450]

### "Fabrication of the InP nanopillars"

This paper presents a way to fabricate nanopillars of InP, which is obtained based on the nanosphere mask by electrochemical etching. The nanopillars are cylinder-shaped, and the smallest feature size can be ~5nm. The results have shown that the formation of the nanopillars is devoted to the areas of the tangency between the nanospheres and the wafer. The blue shift peak of photoluminescence spectra was observed in room temperature, and it was approximately 21meV and attributed to the quantum confinement effect. [C451]

### "Studying the nano structures of Titanium dioxide multilayer produced with gold nano particles depletion in extreme vacuum condition"

In this article, nano layers of Titanium dioxide initially were prepared through evaporation in extreme vacuum (HV) condition on glassy substrate, in a temperature of 100° Celsius exposed from three different angels with 90



nanometers thickness. Then the nano particles of pure gold were accumulated vertically on the layers. The layer depletion situation was the same for all of the layers used in the experiment. The nano structures of these layers will be analyzed in different analytical ways using Atomic Power Microscope, Electronic microscope and Spectrophotometer. The aim of this experiment and observation is essentially to find out the relationship between nano structures of layers and the accumulation condition in extreme vacuum condition and also to observe and analyze how the nano particles of gold settle on the layers in such conditions. The results is quite satisfactory and promising. [C452]

#### "Physical and basic strength of prepared nano structured MgO"

Physico-chemical properties of MgO depend on the method of preparations. MgO with (100) rock salt structure contains surface cavity and defects that are important for their chemical reactivity. In this study, nano structured MgO is prepared by hydration and dehydration method. Its chemical characterize is then translated into its basic strength using back titration method. This study also shows that there comprise two basic sites at the prepared sample; MgOH and MgO centres. As the nano structured MgO were prepared, more surface cavity and defect were present, thus, exposing more O<sup>2-</sup>, which influence the more basic strength. Finally it was found that the basic strength is the highest when the sample nano structures MgO prepared at temperature higher than 500°C. [C453]

#### "Analysing the technology relevance of nanotechnology in product planning"

Emerging technologies like nanotechnology are being considered a driving force for innovation. With impacts to be anticipated for nearly every industry, nanotechnology and applications can be considered cross-section or enabling technologies. In this, however, development in the fields of nanotechnologies is still mostly technology and opportunity-driven. Furthermore, the nanotechnology potential in terms of technological function and utility, with new effects and properties of nano-scaled materials and -structures in particular, are yet to be discovered in enterprises as well as with developers and designers communities. Between the technological bank of nanotechnologies and application banks, a significant gap is to be recognised. Therefore new management approaches are necessary to cope with uncertainty of knowledge in nanotechnology during the early phases of innovation processes and product design. This paper presents an approach for analysing and assessing technology relevance nanotechnology in product planning context. The assessment is based on a product function-related feasibility analysis covering several factors for potential success. The objective is to match the potential effects and properties of nano-materials and -structures with product functions to high-light feasible application fields. Thus, enterprises get a specific assessment of where and how they can apply nanotechnology. A use case shows the application of this relevance analysis by a German enterprise from filling and packing machines industry. [C454]

#### "Use of technology roadmapping in selecting projects for financial support"

Russian State Corporation of Nanotechnologies (RUSNANO) was established by the Federal Law in 2007. Its main activity is selection and co-investing money of the Federal budget in nanotechnology projects that have high potential for commercial or social benefit. RUSNANO investments in selected projects are expected to reach 1,5 bln. US dollars in 2009. RUSNANO uses Foresight and roadmapping techniques to support investment process involving in the activities leading Russian scientific and business institutes. Foresight allow revealing most perspective nano-enabled product groups for implementation in Russia in the long-term perspective and estimating required resources for setting up mass production. Roadmaps allow defining priorities for investments, R&D, staff training, infrastructure advance. They help RUSNANO to define strategic goals and choose the most promising technologies. 10 roadmaps are being developed at RUSNANO: Light emitting diodes, Nuclear energy, Aircraft industry, Spacecraft industry, Medicine and Pharmacy, Water cleaning and purification, Energy saving, Halocarbon composite fibres, Catalysts for petrochemical industry, Effective cutting instruments. More than 400 experts are actively participating in developing the roadmaps. The roadmaps will be ready in first half 2010. The presentation highlights RUSNANO strategic planning approach by an example of one of the developed roadmaps. [C455]

#### "Nano-level 3-D shape measurement method from analysis of interference fringes using RGB LED lightings"

Nano-level 3-D measurement is one of the key technologies for the current and next generation of production systems for semi-conductors, LCDs and nano-devices. To meet with these applications, "Wide range nano-level 3-D shape measurement method using combination of RGB laser lights" has been developed. It measure the height of nano-objects from the combination of RGB LED lights combinations. To analyze the combination of RGB lights, the color analysis method on xy-color plane has been introduced. In this method, the color changes



on xy-color plane means the height changes. Experimental system to measure the three micro-meter height has been developed, and succeeded to measure the 50 nm step and 500 nm step samples. [C456]

### "GPS, Galileo, and nanotechnology: A cost-effective satellite technology?"

The prospects of cost-effective Earth observation missions, using the global positioning system (GPS) and Galileo satellites (GIOVE-A and GIOVE-B) and associated telemetry designs, are migrating toward economical satellites, operational ground stations, efficient data distribution structure, and qualitative space system management. The concept of application specific integrated micro-instruments (ASIM) -microelectronics, integration of micro-electromechanical systems (MEMS), miniaturization, and signal conditioning-enables the development of small satellite technologies. However, cost-effective management of nano- and pico-satellites, rapid data distribution methods, and quality assurance procedures of these mission developments, are far from achievable standard and performance capacity. Thus, this study presents the status quo, possibilities and prospects of small satellite mission activities, research budget and cost drivers toward attaining cost-effective missions, with visions of the future missions and greater involvement of local and small-scale industry. [C457]

### "MEMS structures using polycrystalline diamond single-material micro technologies"

Large band gap materials such as diamond (5.5 eV) and AlN (6 eV) offer the possibility of making MEMS structures out of a single material by varying the doping level to achieve the semi-conducting, metallic and insulating (undoped) properties needed in a typical MEMS structure. Polycrystalline diamond (poly-C), which has recently been used in the fabrication of BioMEMS, RFMEMS, and MEMS packaging, is inexpensive and retains many of the unique properties of single-crystal diamond. However, the development of diamond-based SMM technology faces a number of challenges including (a) producing highly-insulating and highly-conducting poly-C films, (b) creating ohmic contacts, and (c) patterning by dry etching of poly-C films grown on SiO<sub>2</sub>. The results presented in this paper, which addresses these issues for the first time, are expected to lead to SMM based MEMS structures and packaging. [C458]

### "The design optimization for GaN-based betavoltaic microbattery"

In this paper, we demonstrate a p-n junction betavoltaic microbattery which is based on the wide-band gap material of GaN. Ni-63 was used as the pure beta radiant source. By the Monte Carlo (MC) simulation, the trajectories of single-energy electron beam incident on GaN target, the averaging penetration depth and the energy deposition along the penetration path were obtained. According to them, the optimal p-n junction depth was designed. To compare with the design, we have fabricated GaN betavoltaic cells using the metal-organic, chemical-vapor deposition (MOCVD) and the GaN micromachining technology. Under an activity of 11mCi Ni-63 source irradiation, the open circuit voltage of 25 mV and short circuit current of 2 nA were measured in a single 1\*1 cm cell which are far apart from designed values 475 mV and 56 nA. Methods to further increase the performance of the GaN betavoltaic microbattery were discussed. [C459]

### "Formation of the nano-scale archipelago shape upper electrode of capacitive humidity sensor"

We present a clean and convenient technology to form a nano-scale archipelago shape upper electrode of capacitive humidity sensor to substitute the lift-off technology in this kind of process. In our fabrication process of humidity sensor, only the 0.25 second of the beginning of the discharge in a sputtering was used to form the nano-scale archipelago shape electrode. Moreover, the humidity sensitive material which is the key factor in humidity sensor has not been contacted with both acetone and photoresist which were usually used in the process of lift-off. Observed by AFM(Atomic force microscope), the average diameter of island electrode of this archipelago shape electrode is 30 nanometers. The test result showed that this kind of sensor has a wide range of sensing ambient relative humidity from 25% RH to 95%RH. The performance of this capacitive humidity sensor showed that the very short time discharge of sputtering can be an effective, clean and easier method to form the upper electrode of capacitive humidity sensor. [C460]

### "Fabrication of Micro/Nano-filter by building sacrificial structure with colloid crystal"

Fabrication process of a novel multi-scaled filtration membrane for sample pretreatment in microfluidic system is presented in this paper. The membrane has a combinatorial structure with feature size ranging from hundred nanometers to micrometers. A nano-filtration membrane is mosaically embedded into the pores of a microfabricated membrane with crystal structure to get a high filtering flux at a reasonable mechanical strength. After assembling Polystyrene microspheres into the micro-pores and electrodepositing Cu in the interstices of the sphere crystal, a nano-porous structure with feature size of 450nm can be obtained after releasing the sacrificial micro-spheres off in oxygen plasma. All the process of the present micro/nano filtration unit is compatible with the micro-electro-mechanical systems (MEMS) technology and thereby is ready for the multifunction integration



monolithically to construct a micro total analysis system. [C461]

### "Mechano-chemical synthesis of nano leaded brass from oxidized raw materials and the effect of milling time"

Regarding the increasing progress of nanotechnology and the indispensable movement of industry toward applying this technology, the present study attempts to reach to nanostructured leaded brass cutting down the fabrication stages and the subsequent costs. To fulfill this goal mechano-chemical synthesis technique was employed in the controlled argon atmosphere, ambient temperature and 40:1 weight ratio of balls to powder. After 300 hours of milling leaded brass of 30 nanometer was synthesized from oxidized raw materials of several micrometers in size. SEM and X-ray Diffraction (XRD) were to study the final product. Also, the effect of mechanical milling time on particle size of the final product and the microanalysis of the product was examined. [C462]

### "Neocortical frame-free vision sensing and processing through scalable Spiking ConvNet hardware"

This paper summarizes how Convolutional Neural Networks (ConvNets) can be implemented in hardware using Spiking neural network Address-Event-Representation (AER) technology, for sophisticated pattern and object recognition tasks operating at mili second delay throughputs. Although such hardware would require hundreds of individual convolutional modules and thus is presently not yet available, we discuss methods and technologies for implementing it in the near future. On the other hand, we provide precise behavioral simulations of large scale spiking AER convolutional hardware and evaluate its performance, by using performance figures of already available AER convolution chips fed with real sensory data obtained from physically available AER motion retina chips. We provide simulation results of systems trained for people recognition, showing recognition delays of a few milliseconds from stimulus onset. ConvNets show good up scaling behavior and possibilities for being implemented efficiently with new nano scale hybrid CMOS/nonCMOS technologies. [C463]

### "Nanolocalization of features in the patterns produced by Four-beam Laser Interference Lithography"

This paper presents a method for nanolocalization of features in the patterns produced by Four-beam Laser Interference Lithography (FBLIL) using image processing techniques. In the work, the least-squares fitting method was used for nanolocalization of features, having obtained the main parameters of the pattern by both simulation and experiment. The results have shown that the method is useful for the nanolocalization of the pattern features in laser interference lithography. [C464]

### "Analysis of magnetic latching mechanism in the application of bi-stable MEMS switches"

A magnetic latching mechanism of single cantilever and cross torsion beam in the application of bi-stable MEMS switches is presented in this letter. The analytical results show the relationship between the magnetic force induced by the permanent magnet in the work gap and the elastic force of cantilever in the latching process. When the magnetic force is larger or the stiffness of the cantilever is smaller, the driving power consumption and the contact resistance will be smaller and the response will be faster. A cross torsion beam and a magnetic circuit are made up of the magnetic latching structure which has the capability of controlling the outer circuits. All of the components of the device are fabricated by UV-LIGA technology. The test results reveal the latching process with Nano indent tester and can be explained well with the conclusion. [C465]

### "Building reliable embedded systems with unreliable components"

This paper deals with the design of embedded systems for safety-critical applications, where both fault-tolerance and real-time requirements should be taken into account at the same time. With silicon technology scaling, integrated circuits are implemented with smaller transistors, operate at higher clock frequency, and run at lower voltage levels. As a result, they are subject to more faults, in particular, transient faults. Additionally, in nano-scale technology, physics-based random variations play an important role in many device performance metrics, and have led to many new defects. We are therefore facing the challenge of how to build reliable and predictable embedded systems for safety-critical applications with unreliable components. This paper describes several key challenges and presents several emerging solutions to the design and optimization of such systems. In particular, it discusses the advantages of using time-redundancy based fault-tolerance techniques that are triggered by fault occurrences to handle transient faults and the hardware/software trade-offs related to fault detection and fault tolerance. [C466]



### **"Photonic liquid crystal fibers: Towards highly tunable photonic devices"**

Photonic liquid crystal fibers are hybrids that combine inorganic host micro-structured glass substrates with organic guest nanostructured liquid crystals. This combination creates a novel class of nano- and microstructured photonic crystal fibers and simultaneously is responsible for a diversity of new and uncommon material and optical properties. Due to the highest level of tunability induced by external electrical, magnetic, optical or thermal physical fields the effective Photonic liquid crystal fibers technology can be used for highly tunable advanced photonic devices. [C467]

### **"On the design of new low-power CMOS standard ternary logic gates"**

A novel low-power and high-performance Standard Ternary Inverter (STI) for CMOS technology is proposed in this paper. This inverter could be used as a fundamental block for designing other ternary basic logic gates. This circuit consists of only MOS transistors and capacitors without any area consuming resistors in its structure. Another great advantage of this design in comparison with the other designs, introduced before, is the elimination of the static power dissipation, which is very important in nano scale CMOS and leads to less power consumption. The proposed design has been simulated, using Synopsys HSPICE tool with 90nm CMOS technology. The simulation results demonstrate the superiority of the presented design with respect to other conventional designs in terms of power consumption and performance. [C468]

### **"An ESD design automation framework and tool flow for nano-scale CMOS technologies"**

We present a successfully implemented ESD design automation framework that evaluates and verifies the ESD protection methodology at all stages of a standard integrated circuit design flow. The tools used at each step of the flow and sample results showing excellent correlation to hardware test data is presented. [C469]

### **"Periodic nano- and microstructures for reception and transmission of information of the terahertz range"**

We propose fundamentally new technical and constructive solutions to the construction of the receiving and transmitting structures of the terahertz radiation based on apodized and chirped periodic lattices. It is shown that the efficiency can reach about 88% at the resonance frequency of 1.82 THz and simultaneous apodization and chirping of the structures when the number of periods of such a structure equal to five. [C470]

### **"Designing many-core platforms for silicon-efficient embedded multimedia computing"**

Summary form only given. Programmability is a key requirement for fast time-to-market and agile adaptation to rapidly evolving multimedia standards and customer expectations. Unfortunately, programmable architectures come with order-of-magnitude computational density and energy efficiency gaps with respect to custom-fit hardware. Is there a way to escape the flexibility vs. efficiency dualism? Is nano-scale silicon technology adding new facets to this "no free lunch" view? In this talk I will describe key architectural and technology cornerstones of silicon-efficient throughput computing and provide some insight on how we hope to give positive answers to these fundamental questions. [C471]

### **"Nanostructured conformable patch antenna array"**

Carbon nanotube (CNT) has emerged as potential candidate for replacement of conventional metal patch. The principal objective of our research is to develop nanostructure based flexible patch antenna array for multi frequency operation in Industrial, Scientific and Medical (ISM) band. Patch antenna design using CNT on flexible cotton sheets and CNT silver composites as conductive patch and ground plane has been simulated. Due to high conformability and conductivity of CNT all antenna parameters like VSWR, Return loss, Gain and radiation pattern meet design criteria. Our simulated antenna shows a return loss less than -10 dB and VSWR less than 2 at 2.06 GHz, 2.38 GHz and 2.49 GHz. A simulation of a versatile and conformable antenna design has also been done wherein the whole geometry is rolled up like patch array on cylindrical surface. This brings about conformability to the curved surfaces and integration with the structure which results in a unique antenna design. [C472]

### **"Converging micro-nano-bio technologies towards integrated in-vitro testing systems: Current activities and future challenges under the EU-Information & communication technologies program"**

Interdisciplinary research towards integrated systems and their applications based on emerging convergence of information & communication technologies, micro-nano and bio technologies is expected to have a direct impact in healthcare, ageing population and well being. Micro-Nano-Bio Systems (MNBS) research and development



activities under the European Union's R&D Programs, Information & Communication Technologies priority address miniaturised, smart and integrated systems for in-vitro testing (e.g. lab-on-chips) and systems interacting with the human (e.g. autonomous implants, endoscopic capsules and robotics for minimally invasive surgery). Projects addressing in-vitro testing focus on research, development and testing of technology building blocs (e.g. sample preparation technique, ultra sensitive detection technique, chemistry process for molecular recognition and microfluidics) and their integration into smart and miniaturised systems e.g. DNA & protein arrays, biochips, Lab on Chip and Lab on Card. Current challenges and developed solutions as well as open issues to fully meet technological and socioeconomic needs are presented in this paper as background introductory information to the mini-symposium on "MNBS in-vitro testing". Relevant examples of R&D within the group will be presented in the mini-symposium. [C473]

#### **"From miniature to nano robots for diagnostic and therapeutic applications"**

This paper presents the evolution of diagnostic and therapeutic procedures as a process of convergence of technologies coming from different fields and involving different disciplines. In particular, it illustrates how modern surgery evolved thanks to fundamental biology knowledge; thus, with the introduction of imaging techniques intra-operatively and with the introduction of robotics, surgical procedures became much more predictable, precise and effective. Finally, the recent developments of optics (with CMOS and CCD technologies, and with the introduction of fiber optic technologies) allowed to "see" inside the human body, thus reducing the invasiveness of surgical procedures and making diagnostic procedures adequate for an effective early discovery of pathologies. Nowadays, we are assisting to a concrete merging between microrobotics technologies and bioengineering, with the potential to bring therapeutic tools where requested and when requested, with high precision and with very limited side effects. Furthermore, nanotechnology offers the possibility to fully implement this merging, thanks to the development of dedicated theranostic nanotools suitably fitting the considered convergence scenario. [C474]

#### **"A low-power, wireless, 8-channel EEG monitoring headset"**

Micro- and nano-technology has enabled development of smaller and smarter wearable devices for medical and lifestyle related applications. In particular, recent advances in EEG monitoring technologies pave the way for wearable, wireless EEG monitoring devices. Here, a low-power wireless EEG sensor platform that measures 8-channels of EEG, is described. The platform is integrated into a wearable headset for ambulatory monitoring of EEG. While using standard EEG electrodes without conductive gel, a first evaluation shows the wireless headset is comparable to the reference system when looking at alpha wave discrimination. This device combines low-noise, and low-power functionality into an easy-to-use wireless headset, providing a first step towards a fully integrated, fully functional wearable wireless EEG monitoring system. [C475]

#### **"Textile-templated electrospun anisotropic scaffolds for tissue engineering and regenerative medicine"**

Cardiovascular diseases, specifically myocardial infarction and end-stage heart failure represent some of the major pathologies that threaten human life. Here we present a novel approach for a bioactive cardiac patch based on a combination of biomedical and textile manufacturing techniques in concert with nano-biotechnology based tissue-engineering stratagems. The technological goal is to create BioNanoTextiles™ (BNT) by using "conventional" fabrics as templates for creating three-dimensional nanofibrous scaffolds. Electrospinning nanofibrous scaffolds templated after "ordinary" textiles is a novel way to create complex-patterned, 3-D scaffolds intrinsically mimicking some of the anisotropic structural features of the ventricular wall's extracellular matrix. In preliminary studies, we established that this approach will yield anisotropic 3-D scaffolds with mechanical properties dependent upon the yarn type of the textile-templates. These scaffolds are biocompatible, as inferred from their support of H9C2 cardiac myoblast adhesion which promotes their proliferation as well as cardiac-like anisotropic organization. The use of textile manufacturing strategies will enhance the complexity of the 3-D scaffold structures and enable their commercialization, while providing an opportunity for the textile industry to advance established "low-tech" manufacturing technologies into the realm of "high-tech" BioNanoTextiles. [C476]

#### **"Space flight experiment: Advanced solar cells and protective materials on the ISS exterior"**

A space flight opportunity was seized to fly emerging solar cell, coating, and coverglass technologies in a Low Earth Orbit (LEO) environment while attached to the exterior of the International Space Station (ISS). Included in the flight manifest were nano-crystalline optimized amorphous silicon (a-Si) thin-film, Indium Phosphide (InP), and Inverted Metamorphic (IMM) Photovoltaic (PV) technologies. An array of experimental coatings and coverglass technologies completed the sample set, which formed a part of the 2ndForward Technology Solar



Cell Experiment (FTSCE II), which is part of the larger 7th Materials on the International Space Station Experiment (MISSE-7). The design and method of flight article preparation is presented herein, as well as detail of preflight environmental tests. [C477]

#### "Amorphous silicon solar cells on plastic based photonic structures"

Thin film solar cells are an increasingly important technology for photovoltaic energy conversion. For Si based thin films, it is necessary to increase absorption path in order to absorb as many photons as possible. In this paper, we show how one can use a 2 dimensional photonic structure to diffract light and significantly enhance light absorption. The 2D photonic structure consists of precise cylindrical holes fabricated in a polymer using nano-imprint technology. The polymer is then coated with silver and ZnO, and a-Si:H solar cells, both single junction and tandem junction, are deposited on the photonic structure. Significant enhancement in current is obtained in both structures, and quantum efficiency measurements confirm that the photonic structure is giving rise to enhanced absorption in the film. [C478]

#### "A novel approach to the statistical generation of non-normal distributed PSP compact model parameters using a nonlinear power method"

Statistical variability (SV) is one of the fundamental limiting factors for future nano- CMOS scaling and integration of. Variability aware design is essential to achieve reasonable yield and reliability in the manufacture of circuit and systems. To develop effective variability aware design technologies it is essential to have a reliable and accurate statistical compact modeling strategy. In this study a nonlinear power method (NPM) based statistical compact modeling strategy is presented. The results indicate that statistical compact model parameters generated by a NPM approach are significantly better at capturing the tails and non-normal shape of statistical parameter distributions when compared with principal component analysis (PCA). [C479]

#### "Integrated antenna with inkjet-printed compact artificial magnetic surface for UHF applications"

An antenna integrated with a compact engineered surface encompassed of inkjet-printed split ring resonators is presented. The engineered surface behaves as an artificial magnetic conductor thus enabling a low profile antenna design. Inkjet-printing of silver nano-particles on paper substrates facilitates the realization of low-cost light-weight prototypes that are desirable in many real-world applications. [C480]

#### "Investigation and analysis of a MOEMS gyroscope based on novel resonator"

In this paper, a micro-optical-electro-mechanical system (MOEMS) gyroscope was developed taking a new optical microcavity-planar microdisk cavity as the core sensing element. The planar microdisk cavity was designed with high Q value and small volume, and the processing technology of the planar microdisk cavity was discussed in detail with the micro-nano machining process technology. To obtain resonance curve, a resonant cavity proof-of-principle experiment was performed. As the light source and planar microdisk cavity dimensions have a decisive influence on the Q value of microcavity and angular rate measurement limit of gyroscope, a method was discussed that using traditional F-P cavity resonance curve for optimization of planar microdisk cavity geometric parameters. [C481]

#### "A 0.08 mm<sup>2</sup>, 7mW Time-Encoding Oversampling Converter with 10 bits and 20MHz BW in 65nm CMOS"

This work presents an area- and power-efficient realization of a new Time-Encoding Oversampling Converter (TEOC) consisting of a 3rd-order CT loop filter and a self-oscillating PWM which displays similar performance than a standard multibit CT- $\Sigma\Delta$  modulator but has the complexity of a single bit design. The introduced Time-Encoding Quantizer (TEQ) is implemented inside a  $\Sigma\Delta$  modulator by replacing a multibit quantizer. An innovative TEQ is used to overcome design issues in a 1.0V supply-voltage 65nm digital CMOS technology. The TEQ allows an exchange of amplitude-resolution by time-resolution. The approach of time-resolution alleviates the scaling difficulties of mixed-signal circuits in nano-scale technologies. The TEOC features a 63dB dynamic-range and a peak-SNDR of 61 dB over a 20MHz signal bandwidth. Clocked at 2.5GHz, the complete ADC consumes 7mW from a single 1.0V supply, including also the reference buffers. The ADC core results in an attractively small area of 0.08mm<sup>2</sup> and in a Figure-of-Merit (FoM=Pwr/2 BW 2ENOB) of 0.17pJ/conversion-step. [C482]

#### "Analog mixed-signal circuits in advanced nano-scale CMOS technology for microprocessors and SoCs"

Scaling of CMOS technology has made major innovations in the last decade with the introduction of strained silicon and high-k metal gate, however at the same time an increasing amount of complex analog mixed-signal



circuit functionality has been integrated on microprocessors and SOC's. Examples of the key analog mixed-signal circuit functional blocks implemented in advanced 45nm and 32nm logic CMOS on microprocessors and SOC's are described. Techniques that overcome the challenges of the low supply voltage and dimensional scaling in 45 nm and 32nm CMOS include the use of the digital transistor for analog circuits, the use of "digital assist" logic for calibration and differential pair offset cancellation. The co-optimization of design techniques and process enhancements for high performance RF wireless circuits integrated on SOC's was employed to manage complexity and cost. [C483]

#### **"Advanced polymers for advanced RF packaging applications"**

This paper presents advanced polymers for RF packaging applications including filters and antennas. First, micro-scaled LCP technology for front-end modules is presented. Next, nano-scaled ultra-thin RXP technology is introduced with its integration capability and embedded passive performances. Simulated results of bandpass filter, and antennas for 60 GHz are also presented in this paper. RXP technology provides low cost and promising high performance solution for wireless applications operating around microwave and millimeter frequencies. Magneto-dielectric substrates are proposed for effective miniaturization of antennas. [C484]

#### **"A new lifetime diagnostic system for photovoltaic materials"**

We have developed an apparatus for measuring the minority-carrier or recombination lifetime in semiconductors. We have named the technique transmission modulated photoconductive decay (TMPCD). This is a contactless, non-invasive technique that produces transient photoconductive lifetime data. The measurement procedure is very sensitive to small signals and has a superior time response for measurement of short carrier lifetimes. This technology has several advantages over resonant coupled photoconductive decay (RCPCD) and transient microwave reflection photoconductive decay ( $\mu$ PCD). The sensitivity is comparable to that of RCPCD but considerably larger than that of  $\mu$ PCD. The response time advantage provides a capability to measure very short lifetimes in thin film materials, such as amorphous and nano-crystalline silicon films and nanowire composites. This is accomplished while maintaining a sensitivity that is at least comparable to RCPCD. We will show results of the application of this new technique to a wide range of photovoltaic materials. These include silicon wafers, compound semiconductor thin films, nano-crystalline silicon films, and II-VI nanowires. [C485]

#### **"Direct catalytic growth of high-density carbon nanotubes on nanoclusters at low temperatures"**

Carbon nanotubes (CNTs) have received extensive attention due to their one-dimensional structure and ability to demonstrate many novel physical and chemical phenomena in the quantum scale. However, the application of CNTs in electronics is hindered due to their higher growth temperatures which are usually in excess of 500 °C, which is not compatible with current semiconductor technology in industry. Low temperature growth is necessary for integrating CNTs into standard semiconductor devices such as CMOS and large-scale integrated circuits. To date, various techniques have been utilised to lower the CNT growth temperature by: 1. using various carbon sources with lower dissociation temperature; 2. exploring metal catalyst films of the low melting point or metal nanoparticles as catalysts; and, 3. introducing a plasma during deposition to increase the dissociation and ionization of feed gases. In this study, we report the low temperature growth of vertically aligned high-density CNTs by a DC plasma chemical vapour deposition method, using Ni nanoclusters as catalysts. The Ni nanoclusters are free from a high-temperature formation process compared to the film based catalysts and directly demonstrate catalytic growth of CNTs at substrate temperatures as low as 390 °C. The density of as-grown CNTs is up to 10 /cm, as shown in Figure 1. Transmission electron microscopy studies show the CNTs are made of crystalline graphene shells and have a uniform diameter distribution. The field electron emission properties of the samples are investigated. [C486]

#### **"Bistable resistance switching of Cu/Cu: HfO<sub>2</sub> /Pt for nonvolatile memory application"**

The resistance switching characteristics of Cu doped HfO<sub>2</sub> film are investigated for nonvolatile memory. Two stable states can be achieved under both pulse and DC electrical stress. Good performances including large storage window, fast operation speed, good endurance, and long time retention are shown in this device. The metallic filament is confirmed as the physical origin for resistance switching based on the temperature test. [C487]

#### **"A low-cost memristor based on titanium oxide"**

Memristor has been extensively investigated as the fourth fundamental circuit element. A common material in fabricating memristors is titanium oxide. The growth of titanium oxide has so far been focused on atomic layer deposition or sputtering, which is expensive. In this paper, a low-cost memristor device is demonstrated based on titanium oxide, grown by the thermal oxidation of deposited Ti film with a low-temperature process. Both the



high and low resistance states of the device can be continually modulated by the successive voltage sweeps. Moreover, multilevel storage can be achieved in the device by using various maximum voltages during the set process. [C488]

### "Future High density Memory with Vertical structured device technology"

For the past thirty years, the downscaling has been the guiding principle in the field of High-density semiconductor memories. However, recently, the limit of planar bulk MOSFETs is becoming apparent. Therefore, in order to extend the scalability of memory technology to the nano-scale generation, a new device structure is necessary. From the viewpoint, I will discuss future High density Memory with Vertical structured device technology. [C489]

### "Multilevel storage characteristics in ZrO<sub>2</sub> -ReRAM brought about by ideal current limiter"

1T1R-architecture devices were fabricated by integrating ZrO<sub>2</sub>based crossbar structure ReRAM onto a foundry-built MOSFET platform. Multilevel operation was realized by using the current limit of a selected cell transistor in the set process. The current level was determined by the transistor's gate voltage, resulting in the control of electrical resistance of the filamentary conductive paths in the low resistive state. [C490]

### "Novel Terahertz nanodevices and circuits"

Terahertz (THz) technology has attracted rapidly increasing attention due to a very broad range of potential applications, e.g., medical imaging and homeland security. Perhaps more importantly, developing electronic devices capable of operating at THz frequencies will have great impact on future generation computation and communication. Despite enormous effort in recent years, THz field is still largely unexploited due to the bottleneck issue of the lack of compact, solid-state, room-temperature detectors and emitters. Here we overview our recent work on the THz operations of novel nano-diodes that can detect and emit THz waves at room temperature. Apart from the very high speed, these novel diodes also have characteristics such as zero threshold and quadratic rather than exponential current-voltage response, which are particularly important for applications including THz imaging and energy harvesting. These unique characteristics are possible because the planar nanodevices are based on completely new working principles from conventional diodes, i.e., the rectifying functionality does not rely on any pn junction or tunneling barrier. In our experiments, different antenna structures including spiral, dipole and bow-tie are fabricated to couple the nanodevices to free-space THz waves up to a few THz. Apart from THz imaging and communications, the possibility to extend the technology to mid-infrared frequencies for heat energy harvesting is very attractive because of the potentially high efficiency and low cost as compared with conventional thermoelectric devices. [C491]

### "Scaled silicon nanoelectromechanical (NEM) hybrid systems"

In this paper we overview recent attempts at co-integrating silicon nano-electro-mechanical systems (NEMS) with nanoelectronic devices aiming to add more functionalities to conventional electronic devices in 'More-than-Moore' domain and also explore novel operating principles in 'Beyond CMOS' domain. [C492]

### "Resistive switching mechanism of Cu doped ZrO<sub>2</sub> -based RRAM"

ZrO<sub>2</sub>-based resistive random access memory devices composed of a thin Cu doped ZrO<sub>2</sub>film sandwiched between an oxidizable top electrode and an inert bottom electrode are fabricated by e-beam evaporation at room temperature. The devices show reproducible nonpolar resistive switching. The formation and annihilation of localized conductive filaments is suggested to be responsible for the resistive switching characteristics according to a series of convincing evidences. Temperature-dependent resistive switching behaviors show that a metallic conductive channel is responsible for the low resistance state. Further analysis reveals that the physical origin of this metallic channel is the nanoscale Cu conductive filament. The metal filaments are observed by TEM and the component is also confirmed. We propose that the set and reset process stem from the thermal effect assisted electrochemical reactions. [C493]

### "New functional devices fabricated by bio nano process"

The memory effect in floating nanodot gate field effect transistor (FET) was investigated by fabricating biomineralized inorganic nanodot embedded metal-oxide-semiconductor (MOS) devices. Artificially biomineralized Co oxide cores accommodated in ferritins were utilized as a charge storage node of floating gate memory. Two dimensional array of Co oxide core accommodated ferritin were, after selective protein elimination, buried into the stacked dielectric layers of MOS capacitors and MOSFETs. Fabricated MOS capacitors and MOSFETs presented a clear hysteresis in capacitance-voltage (C-V) characteristics and drain current-gate voltage (ID-VG)



characteristics, respectively. The observed hysteresis in C-V and ID-VG are attributed to the electron and hole confinement within the embedded ferritin cores. These results clearly support the biologically synthesized cores work as charge storage nodes. This work proved the feasibility of the biological path for fabrication of electronic device components. [C494]

#### "Investigation of tunneling field effect transistor reliability"

This paper summarizes our recent investigations of nano-wire n type tunneling field effect transistor (n-TFET) reliability by experimental measurements and physical analysis [1-3]. Large PBTI and HC degradations which are very different from those in conventional n-MOSFETs were observed. The results are interpreted by different degradation mechanism in TFET. [C495]

#### "3-D matrix nano-wire transistor fabrication on silicon substrate"

A simple top down method to fabricate an array of vertically stacked nanowires is presented. By taking advantage of the non-uniformity of the Inductive Coupled Plasma (ICP) etching process to form a scalloped sidewall followed by a subsequent stress limited oxidation step, a narrow silicon fin can be vertically patterned to form stacked nanowires with different cross-sectional shapes. The stacked nanowires have been used to fabricate Gate-All-Around (GAA) MOSFETs that show excellent characteristics. [C496]

#### "Application of nanotechnology on hydraulic turbine abrasion and erosion"

When operating in high silt content flow, the hydraulic turbine is easily destroyed by abrasion and erosion of sediment. Nano WC/Co -High velocity oxygen flame (HVOF) sprayed coating is good to protect hydraulic turbine. Nano WC/Co coating is characterized by its small size of crystal boundary, high bond strength, high hardness, better rupture strength and good corrosion resistance so that the protective coating has high resistance to the high-speed jet. The author described the present conditions of our country's hydraulic turbines' wear erosion, the characters of nano coating and the application of nano coating on the turbine units anti abrasion in this article. [C497]

#### "Quantum chemical approaches to the electronic structures of nano-electronics materials"

Nano electronics materials have been investigated in terms of novel local quantities. We show the importance and availability of these quantities. Particularly, three types of quantities are paid special attention in this work. First one is the polarizability and dielectric constant density tensor. By these quantities, the linear response to the external electric field is investigated in atomic viewpoints. Second one is the spin torque and the zeta force. These quantities clarify the local dynamics of the spin of electrons, i.e., local torque and equation of motion. Therefore, this quantity is extremely useful for, e.g., a field of spintronics. The last one is the local conductivity. This quantity is the linear response of the local electronic current to the external and internal electric fields, which are related to each other by the dielectric constant density. [C498]

#### "Preparation and characterization of low-dielectric-constant F-doped SiOCN films by PECVD"

F-doped SiOCN films with low dielectric constant have been prepared using SiH<sub>4</sub>, C<sub>2</sub>F<sub>6</sub> and N<sub>2</sub>O as reactants by PECVD, and characterized by X-ray photoelectron spectroscopy (XPS), capacitance -voltage (C-V) and current-voltage (I-V) measurements, and nano-indenter. With an increment of the flow rate of C<sub>2</sub>F<sub>6</sub>, the concentrations of fluorine and carbon incorporated in the films increase, and the concentration of nitrogen decreases. This leads to a decrease in the dielectric constant of the film. When the flow rate of C<sub>2</sub>F<sub>6</sub> is 750 sccm, the percentages of C and F elements amount to 5.2% and 9.9%, respectively. Meanwhile, the resulting dielectric constant is reduced to 2.6, and the leakage current density is lower than 3.4 × 10<sup>-8</sup> A/cm<sup>2</sup> at 1 MV/cm. The hardness and Young's modulus of the films are higher than 3 GPa and 84 GPa, respectively. It is thus believed that the introduction of carbon and fluorine can lower the dielectric constant of the films, and the presence of N can improve the mechanical properties of film. [C499]

#### "DNA Sequencing with nanopore-embedded bilayer-graphene nanoelectrodes"

We propose the use of bilayer graphene as nanoelectrodes for solid-state nanopore-based DNA sequencing, and perform molecular dynamics simulations and electrical transport property calculations to explore the potential merits of this proposal. The results of our investigation show that compared to single-layer graphene nanoelectrodes, bilayer graphene drastically raises the conductance by 1~2 orders of magnitude while retaining the advantage of single-base resolution characteristic for graphene nanoelectrodes. We conclude that the application of bilayer graphene indicates a promising approach to significantly improve the accuracy of the measurement process in DNA sequencing. [C500]



### "Direct observation of channel hot-electron energy in short-channel metal-oxide-semiconductor field-effect transistors"

An experimental method is proposed to extract the channel hot-electron (CHE) energy ( $\phi_e$ ) in the nano-meter-scaled metal-oxide-semiconductor field-effect transistors (MOSFETs). Accelerated by localized electric field in the drain induced channel depletion region, the CHEs obtain larger kinetic energy than the other unaccelerated channel electrons, and they gain greater probability of tunneling through the gate oxide so as to enlarge the gate leakage current. By monitoring the CHE enhanced gate leakage transients and solving the one-dimensional Schrodinger equation, the reduced gate barrier height ( $\phi_B$ ) and the  $\phi_e$  can be extracted. This method is applicable to the shortchannel MOSFETs with a channel length less than 150nm with promising accuracy, and it is advantageous owing to its simplicity and timely-applicability to the very recent ultra-small-feature-sized MOSFETs. [C501]

### "Ge/SiO<sub>2</sub> low temperature wafer bonding"

Atomic level Ge/SiO<sub>2</sub> direct wafer bonding was achieved at 150°C. The microstructures of the bonding interface were characterized by transmission electron microscopy. Our investigation indicated that the completed Ge/SiO<sub>2</sub> bonding interface without nano-gaps can be required only if the proper pretreatment was applied. That is probable reason that the high defect (a great number of pits) density on the surface of the transferred Ge layer in GeOI was caused through these buried interface nano-gaps which were invisible by an infrared inspect due to the limited resolution. [C502]

### "Silicon photonics technologies for monolithic electronic-photonic integrated circuit applications"

To overcome the severe information latency and power consumption, and enable significant parallelism based on a radically new communication landscape, instead of the conventional Cu-interconnect, will be a remarkable breakthrough. Converging electronic and photonic integrated circuits (EPIC) on a single chip platform to enable functional diversification emerges as one promising approach which could be realized by taking the advantage of low energy and huge data capacity of optical interconnects. By leveraging on the wealth of CMOS technology know-how and infrastructures, the fundamental photonics building blocks that are essential for the demonstration of EPIC platform have been successfully developed in this work. We present an overview on the current status of this critical technology development and provide an outlook for the monolithic integration of Si micro- and nano-photonics. [C503]

### "Wafer-level magnetotransport measurement of advanced transistors-making a powerful technique even more powerful"

For transistor research and development, one of the important figures of merit is the carrier mobility. The measurement of mobility is cumbersome in large devices, and nearly impossible in nano scale devices. Very often, effective mobility ( $\mu_{eff}$ ) is extracted from the I-V curve instead. There are many pitfalls in equating  $\mu_{eff}$  to mobility ( $\mu$ ), including charge-trapping and series resistance effects. The error can be quite large. This is a urgent issue for advanced CMOS technology. In this paper, two novel advances in mobility measurement introduced by our group recently are presented. Both are Hall Effect based and are well known. Our innovations enable both techniques to be deployed easily in any laboratory as well as factory floor. [C504]

### "Outlook for 15nm CMOS research technologies"

So far the most aggressive manufacturing forecast for 22nm technology node is in late 2011, and there still remains many arguments for its next generation, 15nm manufacturing technologies. The major obstacles in front of the manufacturing are (1) high cost fine patterning technology, (2) tradeoff of SRAM cell size and performance, (3) increasing variability, (4) short channel effect control, etc. In this paper our efforts tried to access 15nm CMOS device for preliminary research study will be reviewed, including (1) Nano-injection lithography, (2) operation of record small SRAM cell, (3) discrete dopant simulation, and (4) device design for extremely scaled device. [C505]

### "Potential application of thin-film nanotechnologies in third-generation Si solar cells"

For the development of third generation Si solar cell with high conversion efficiency over 15% and low manufacturing cost, four thin film nanotechnologies have been proposed, including a photovoltaic material system of SixGe1-x-Si-SiyC1-y with multiple bandgaps, a very dense array of Si-based quantum-dots with UV-to-NIR opto-electronic response, surface plasmonic metal nano-particles with light trapping effect, and ZnO nanowires with anti-reflection function. [C506]



### "Influence of powerful ultrasonic treatment on the structure of dry ceramic nanopowders"

Influence of the non-cavitational powerful ultrasonic action (PUA) on the particle size distribution and lattice parameters of crystallites of zirconia and alumina dry nanopowders have been studied. The ultrasonic treatment occurred into the acoustic waveguide having a cavity, filled by dry nanostructured powder (NP). The PUA of different power was used to various dry NP:  $\text{ZrO}_2\text{-}8\%\text{Y}_2\text{O}_3$  (TZ-8Y, TOSOH);  $\text{ZrO}_2\text{-}3\%\text{Y}_2\text{O}_3$  (TZ-3YS, TOSOH);  $\text{ZrO}_2\text{-}3\%\text{Y}_2\text{O}_3$  (PCZY, Siberian Chemical Plant, SCP);  $\text{Al}_2\text{O}_3$  (UDPO, SCP). It was found that non-cavitational PUA influences the lattice parameters and average agglomerate sizes of dry zirconia and alumina NP. There are extreme PUA powers at which extreme values of the lattice parameters and average agglomerate sizes are correlated. The crystal structure of the TZ-3Y (synthesis by spray-drying) is more stable against PUA than PCZY (plasma-chemical synthesis). [C507]

### "Functionalized graphene sheet/polyurethane nanocomposites: Effect of particle size on the physical properties"

The percolation threshold in the nanocomposite of functionalized graphene sheet (FGS) and thermoplastic polyurethane (TPU) reduced effectively by increasing the particle size of FGS. That is the FGS with average size of  $8.3\text{ }\mu\text{m}$  has the percolation threshold at  $0.4\text{ wt}\%$  in the nanocomposite of TPU, whereas it was more than  $1.4\text{ wt}\%$  when the FGS size was  $2.4\text{ }\mu\text{m}$ . The effect of FGS size on mechanical and other properties were also examined. [C508]

### "Self-powered nanosystem: From nanogenerators to piezotronics"

In this paper a new approach for converting nano-scale mechanical energy into electric energy by piezoelectric zinc oxide nanowire arrays is discussed. The operation mechanism of the nanogenerator relies on the piezoelectric potential created by an external strain; a dynamic straining of the nanowire results in a transient flow of the electrons in the external load due to the driving force of the piezopotential. We have developed the nanogenerator from fundamental science, to engineering integration and to technological scale-up. We have fabricated a series of devices that rely on a coupling between semiconductor and piezoelectric properties and are controlled/tuned by externally applied force/pressure, such as diode, strain sensor and strain-gated logic units, which are a new field called piezotronics. A three way coupling among piezoelectricity, semiconductor and photonic excitation has demonstrated the piezo-phototronic effect. [C509]

### "DC voltage current characteristic of Silicon Carbide/ low-density polyethylene composites"

In this paper, nonlinear composite materials were prepared by filling Silicon Carbide (SiC) powder into low-density polyethylene (LDPE). The effect of contents and particle sizes of SiC on the DC voltage current characteristic of SiC/ LDPE composite materials was studied. The results showed that the conductivity and non-linear conductive coefficient of the composites increased with the contents of SiC. The particle size of SiC had no effect on the DC voltage current characteristic of composites when filler concentration was low, while when the concentration was increased, the conductivity and non-linear conductive coefficient of composites increased with particle size of SiC. The conductivity and non-linear conductive coefficient of the composites filled by nano-meter SiC were superior to those of the composites filled by micro-meter SiC with the same content. [C510]

### "A flexible, highly-sensitive, and easily-fabricated carbon-nanotubes tactile sensor on polymer substrate"

A flexible, highly-sensitive, and easily fabricated carbon nanotubes (CNTs) tactile sensor is reported in this paper. CNTs are grown and patterned on bulk-micromachined silicon substrate with 3-dimensional surface profile. After polymer molding, the CNTs with 3-dimensional distribution are successfully transferred onto a flexible PDMS with 3-dimensional tactile-bump. Advantages of presented tactile sensor are (1) exactly determine loading force by resistance change due to almost linearly current-voltage (I-V) characteristics, (2) embedded patterned CNTs into polymer using simple silicon-substrate molding process, (3) 3-dimensional distributed CNTs enable the detection of shear and normal forces, and (4) 3-dimensional polymer structure by molding as a tactile-bump. One of anisotropic-type patterned CNT approach behaves good sensing sensitivity of both normal ( $23\%/N$ ) and shear ( $18\%/N$ ) forces loading. With proper CNTs designs, tactile sensor has normal and shear forces sensitivities of up to  $23\%/N$  and  $95\%/N$ , respectively. [C511]

### "Detecting the interface state of organic thin-film transistors through hysteresis characteristics"

Under white-light irradiation, thin film transistors based on copper phthalocyanine (CuPc) exhibited obvious hysteresis effects when applying bi-directional sweeping gate voltage, the hysteresis window comes up to  $32\text{ V}$ .



This hysteresis effect is the result of those accumulated photogenerated carriers trapped in the interface, which proposed a feasible way to detect the state of the interface between organic functional materials and the dielectric layer. [C512]

#### **"Plasma immersion ion implantation: From microelectronics to biomedical engineering"**

Plasma immersion ion implantation (PHI) is a very useful technique in the fabrication of silicon-on-insulator and high-k dielectrics and is commercially used to produce shallow junctions in deep-sub micro meter integrated circuits. The applications of PHI are in fact much broader covering many other areas such as metallurgy and particularly biomedical engineering. Many of the innovations and protocols developed for PHI in semiconductor applications have been translated to the processing of biomedical components. In this invited talk, our recent work of PHI related to biomedical science and engineering is reviewed. As an important material in bioMEMS, the biocompatibility of single-crystal silicon must be improved. Our experiments indicate the osteo-compatibility of crystalline silicon can be improved by hydrogen plasma immersion ion implantation. The ability to grow apatite (bone) on silicon stems from the hydroxyl bonds on the silicon surface after hydrogen PHI and the amorphous surface created by ion bombardment. The concept has been expanded to hip joints with a plasma-sprayed titania and improved surface biocompatibility can indeed be attained by hydrogen PHI, nano-powder plasma spraying, and irradiation with ultra-violet light. Our recent work on materials which are used as both high-k dielectrics in microelectronics and biomedical coatings on biomedical implants is described. By means of plasma immersion ion implantation, the surface osteo-compatibility of high-k materials such as ZrO<sub>2</sub> can be improved. The mechanism of the improvement will be discussed. A couple of new innovations in this area such as plasma treated polymers and medical devices used to automatically correct spinal problems such as scoliosis will be presented in this invited talk. The latter has in fact gone into clinical trials with a number of patients having been implanted with the correction devices surgically. [C513]

#### **"Micro/nano technologies towards smart systems integration"**

The micro and nano system technologies as well as electronics are playing a key role in today's product development and industrial progress. They enable the integration of mechanical, electrical, optical, chemical, biological and other functions into a very small space with dimensions ranging from sub micrometers up to some millimeters. This paper presents different examples of MEMS sensors and systems developed at Fraunhofer ENAS and Chemnitz University of Technology. It starts with silicon based technologies applied for MEMS laser displays and miniaturized MEMS spectrometer. The integration of new materials and new technologies is shown for point of care diagnostics. [C514]

#### **"Theoretical study on geometry and temperature effects of thermoelectric properties of Si and Ge nanowires"**

Thermoelectric properties of Si and Ge nanowires are studied theoretically using sp<sup>3</sup>d<sup>5</sup>s\* tight-binding and ballistic transport approach. We found that the Seebeck coefficient and power factor per area depend on the nanowire size and its orientation. In addition, for nano-scale nanowires, cross-sectional shape effect is considerable and transmission mode dominates the performance. Temperature also has a great impact on the thermoelectric performance of nanowires. The power factor of Si nanowires along different orientations is approaching to the same value as temperature growing higher than 300 K; while power factor of Ge nanowires along [100] is the largest at high temperature, but the smallest at extreme low temperature. [C515]

#### **"Study of 20nm bulk FINFET by using 3D full band Monte Carlo method with Effective Potential Quantum Correction"**

As MOSFETs scaling down to nano-scale, short channel effect(SCE) become a critical issue. Multiple channel MOSFET structure such as FINFET has well gate controllability on channel charge, and will be used in nano-scale CMOS technology. In this work the performance of 20nm bulk FINFET is investigated by Using 3D full band Monte Carlo Method with Effective Potential Quantum Correction. Gate and drain bias affect on the carrier density, velocity and energy distribution are introduced. The transit time and SSEC Cgs and Cgd as a function of Vds are showed. Results show about 0.1 psec intrinsic transit time at on state in this 20nm gate length device. [C516]

#### **"InGaN/GaN multi-quantum-well nanowires and light emitting"**

InGaN/GaN multi-quantum-well (MQW) nanowires and accordingly light-emitting-diodes (LEDs) were fabricated on the n-GaN/sapphire substrate with a nano-patterned SiO<sub>2</sub> film as growth mask. The structural characteristics, optical and electrical properties were investigated. the observed results show that a InGaN/GaN MQW nanowire



has smooth surface morphologies and triangular cross sectional structure. A strong cathodoluminescence emission peak related to InGaN/GaN MQW is observed located at 461 nm. In addition, InGaN/GaN MQW nanowire LED shows typical p-n junction characteristics with a low turn-on voltage, and its electroluminescence displays purplish. [C517]

#### "Impact of electron rebound from drain on drive current in nano-scale InGaAs MOSFETs"

We theoretically investigate the mechanism of the electron rebound from the drain into the channel and its impact on the drain current in the nano-scale InGaAs MOSFETs by using the quantum corrected Monte Carlo (MC) simulation. The electrons almost ballistically transport in the channel at the gate length,  $L_g$ , of 10 nm. However the electron rebound becomes pronounced instead when the electrons degenerate at the bottleneck. Consequently the average electron velocity at the bottleneck,  $v_s$ , decreases. This considerably diminishes the potential of the InGaAs MOSFETs for the current drivability. [C518]

#### "Study on preparation of electro less nickel plating on the surface of nano-fullerene crystals"

In order to improve the nano-fullerene crystals' dispersion, and keep itself excellent performances, the surface metallization is achieved by electro less nickel plating; The preparation of electro less was studied; the micro appearance was watched; the element composition was examined; the Zeta potential of the nano-fullerene crystals was detected; All the results show that way of surface metallization made the nano-fullerene crystals effectively disperse in liquid, it is favorable to improve its compatibility with the metal matrix. [C519]

#### "An image encryption algorithm based on DNA self-assembly technology"

DNA self-assembly that is fast developed in the fields of DNA computing and nano technology has become the focus of scientific fields. DNA self-assembly is a method that uses the characteristics of base-pair to form polyhedron or super molecular structure. This is a complex progress from disordered to well-ordered, from simple to complicated. This paper mainly introduces that the DNA self-assembly technology is applied into the image encryption. In this paper, we proposed a complete design scheme of DNA tiles that is suitable for the image encryption. The DNA tiles mainly include five types, namely DNA tiles of the plaintext, DNA tiles of the encryption, DNA tiles of the ciphertext, DNA tiles of the key and DNA tiles of the decryption. Through a simulate example, the effect of the image encryption algorithm is shown. [C520]

#### "Designing current mirror with Nano wire FET"

As Nano technology develops more each day and Nano electronic devices come to realization it is obvious that the next step of development would be Nano circuits. Considering the technology difference between the usual 0.1  $\mu\text{m}$  CMOS and Nano scale transistors it is mandatory to fabricate the whole IC with Nano technology circuits. The need for a current source in almost all of the integrated circuits and the common usage of current mirror creates the necessity to design one with Nano technology. Therefore what we have presented in this paper is the design of a current mirror circuit, which uses Nano transistors instead of the usual CMOS transistors. There are two main types of Nano transistors at present, Nano wire transistors and carbon Nano tube transistors; Nano wire transistors will provide a higher output current than carbon Nano tube transistors and better output impedance; which is why we have chosen Nano wire transistors (NWT) for our purposes. The current mirror we used here is an accurate current mirror source suitable for mixed signal IC applications for its stability and high output impedance. [C521]

#### "Functional 3-D magnetic nanostructures"

Most of magnetic nano-structures today are ultrathin or nanostructured films and multilayers. The main challenge is to find a suitable technology to integrate and to contact nanostructures in a reliable manner. Here, we investigate the problem of contact integration into functional 3-D devices and evaluate the influence of 3-D magnetic layer geometry on performance of magneto-electronic devices. Real devices are truly 3-dimensional structures. Their topography must absolutely be taken into consideration during the design phase since their inherent non-planarity will profoundly affect their magnetization profile. Our initial results strongly indicate that the "non-flatness" of magnetic layer strongly influences the possible magnetic states, alters the switching mechanism and leads to totally new behavior, which was not observed in classic 2-D thin film magnetic structures. [C522]

#### "Thermal Analysis of High Speed PM Generator used for distributed generation system"

A 100kW level High-Speed Permanent Magnetic Generator (HSPMG) used for distributed generation systems is electro-thermal analyzed with coupling in this paper. Its electromagnetic performances is analyzed by using time step FEA, from which the electromagnetic performance and loss distributions in machine under rated operating



are determined. Based on the determination of associated heat transfer conditions, the whole region two-dimensional thermal field is calculated. Then, thermal performance of HSPMG with stator oil separators made of nano AlN and ceramic material are studied, and also the cooling structure without oil separator is analyzed. Meanwhile, thermal affection of the insertion of ceramic gradient thermal barrier coatings between rotor magnets and sleeve is researched, and temperature distributions of machines with different thickness thermal barrier coatings are studied. Some conclusions about influences of material and structure on HSPMG thermal performance are obtained, which may provide useful reference for the design and research of HSPMG. [C523]

#### **"Modeling and simulation of anode-supported planar intermediate temperature solid oxide fuel cell for integrated gasification fuel cell application"**

The capability of exploiting various fuels is one of the advantages of solid oxide fuel cells (SOFC) on stationary power application, and also a promising solution for using coal through the integrated gasification fuel cell (IGFC) application when combined with a proper coal gasifier and gas reformer. Recently, the anode supported planar SOFC becomes a promising candidate for SOFC commercialization due to its higher power density and lower operation temperature. In the work, SOFC and commercially available coal gasifiers and reformer are modeled in MATLAB. The fuel cell and reformer models are built using electrochemical and reaction kinetics equations with empirical data determined parameters using literature data. The integrated semi-empirical IGFC model and simulation guide the selection of appropriate coal gasifier and reformer for a given SOFC in IGFC application. Tests have been done using two different and representative gasifiers with different syngas to fuel the SOFC, to demonstrate the performance difference and the method for identify the best SOFC, gasifier-reformer match. Simulation results showed good consistency with literature data. The work contributes new integrated coal gasification and SOFC system development for improved energy efficiency and emission reduction. [C524]

#### **"Unguided optical bus for next-generation computers: Simulation of the motherboard"**

The importance of the development of high-end computers (HEC) lies in their ability to solve complex problems in many areas of science and engineering. In order to develop the next generation of HEC faster buses are required. However, faster buses cannot be achieved in a cost-effective way by means of further scaling of today's electrical technology. Some of the parameters that prevent this further scaling include power dissipation, chip pin-out, RF interference and clock propagation delay in addition to huge energy consumption. In order to overcome the scaling limitations related to electrical buses without using cumbersome and bulky fiber/w optical links, the concept of the unguided optical communication bus (UOCB) has been introduced. UOCB is a technology for transmitting information through material from one point to many points without a waveguide, while taking advantage of scattering and diffusion effects. In this work we analyze the mechanical and optical characteristics of polycarbonate in order to evaluate its potential as a candidate material for UOCB motherboard fabrication. We compare mechanical characteristics, such as Young's module and Poisson's ratio, of conventional motherboard materials (FR4) to polycarbonate and conclude that polycarbonate could satisfy the mechanical requirements. Monte-Carlo simulations were performed on the basis of the optical characteristics of the polycarbonate doped by nano-particles and the physical dimensions of the motherboard. The results of the work indicate that the proposed concept could support next generation bus architecture. [C525]

#### **"Query reformulation strategies in an interdisciplinary digital library: The case of nanoscience and technology"**

This paper reports an investigation of the search behaviour patterns of nanoscience and nanotechnology searchers as revealed by transaction log analysis of the NANOnetBASE electronic book digital library. In particular, it examines the search and query reformulation patterns and strategies of nano searchers. The results show certain query formulation and reformulation patterns associated with searching in an emerging and interdisciplinary area of nanotechnology such as: the use of multiword and compound query terms, extensive use of search terms beginning with the prefix 'nano', hyphenated terms, spelling variations, a large number of query reformulations, and the use of acronyms. [C526]

#### **"Towards cool and reliable digital systems: RT level CED techniques with runtime adaptability"**

In response to the rising fault susceptibility of ICs due to aggressive device scaling, a number of concurrent error detection (CED) techniques have been proposed. Most existing techniques address the problem at device or logic level. To account for the significant process variations and device aging of today's nano-meter devices, these techniques must always aim at the worst case of fault susceptibility. Recognizing that the power consumption of the CED circuitry for different fault susceptibility varies significantly, these techniques could result in significant overhead. In this paper, we propose register transfer level CED techniques that can be adjusted at runtime according to the actual need. The proposed high-level synthesis technique ensures that the generated



datapath consumes minimal power for any CED capability it has been turned to. The proposed approach is tested using known benchmarks. [C527]

### "Crosstalk modeling to predict channel delay in Network-on-Chips"

Communication channels in Network-on-Chips (NoCs) are highly susceptible to crosstalk faults due to the use of nano-scale VLSI technologies in the fabrication of NoCs. Crosstalk faults cause variable timing delay in NoC channels based on the patterns of transitions appearing on the channels. This paper proposes an analytical model to estimate the timing delay of an NoC channel in the presence of crosstalk faults. The model calculates expected number of 4C, 3C, 2C, and 1C transition patterns to predict delay of a K-bit communication channel. The model is applicable for both non-protected channels and channels which are protected by crosstalk mitigation methods. Spice simulations are done in a wide range of working conditions to validate the proposed model. Delays extracted from the simulations are compared with those obtained from the model. Comparisons show that the proposed model accurately estimates the delay of NoC channels. In addition, the proposed model accelerates the evaluation phase of any crosstalk mitigation method by at least three orders of magnitude.

[C528]

### "First principles prediction of materials for spintronics: From bulk to nano"

The continued down-scaling of complementary metal-oxide-semiconductor (CMOS) devices requires replacement of the conventional Si dioxide or oxynitride dielectric by alternative high-k materials immediately. For long term consideration, electron devices may be replaced by spintronic devices which make use of both charge and spin, two fundamental properties of electron. However, to realize these, many materials issues to be addressed. Materials design based on computational methods is playing an increasingly important role in today's materials science and engineering research. Among the various approaches, the first-principles electronic structure method based on density functional theory (DFT) is ideal for designing new materials because such methods do not require experimental inputs and prior knowledge on the materials. We have been using first-principles method to study properties of materials for future advanced technologies and to design new materials. Some of our recent works are discussed. [C529]

### "Nanogenerator and nano-piezotronics"

Summary form only given. Developing wireless nanodevices and nanosystems is of critical importance for sensing, medical science, environmental/infrastructure monitoring, defense technology and even personal electronics. It is highly desirable for wireless devices to be self-powered without using battery. This is a new initiative in today's energy research for micro/nano-systems in searching for sustainable self-sufficient power sources. It is essential to explore innovative nanotechnologies for converting mechanical energy, vibration energy, and hydraulic energy into electric energy that will be used to power nanodevices. We have invented an innovative approach for converting nano-scale mechanical energy into electric energy by piezoelectric zinc oxide nanowire arrays. The operation mechanism of the nanogenerator relies on the piezoelectric potential created by an external strain; a dynamic straining of the nanowire results in a transient flow of the electrons in the external load due to the driving force of the piezopotential. We have developed the nanogenerator from fundamental science, to engineering integration and to technological scale-up. As today, a gentle straining can output 1.2 V from an integrated nanogenerator, using which a self-powered nanosensor has been demonstrated. A commercial LED has been lit up. This is a key step for developing a totally nanowire-based nanosystem. Alternatively, by substituting the gate voltage in a field effect transistor (FET) with the piezopotential creating by an external strain, we have fabricated a series of devices that rely on a coupling between semiconductor and piezoelectric properties and are controlled/tuned by externally applied force/pressure, such as diode, strain sensor and strain-gated logic units, which are a new field called piezotronics. A three way coupling among piezoelectricity, semiconductor and photonic excitation has demonstrated the piezo-phototronic effect. [C530]

### "Thermal ageing of electrically conductive micro/nano adhesives"

Electrical as well as mechanical properties of electrically conductive adhesives can be modified by addition of different types of nanoparticles. It has been investigated if changes of the resistance of adhesive joints caused by thermal ageing will differ in dependence on the type of nanoparticles added into adhesives. It has been found that adhesive joints formed of adhesives modified such the way have the same dependence of the resistance on the conditions of thermal ageing. That means, that nanoparticles added into adhesive in concentration up to 2,5% b. w. does not cause changes of an ageing mechanism of adhesive matrix. [C531]

### "Electro-magnetic sensing and actuation array on silicon substrate platforms"

Electromagnetic arrays can be precisely constructed on silicon CMOS technology as a platform for collective



non-contact sensing and manipulation of magnetic or magnetized particles of micron to nano scale. Such platforms become a tool to interact with nano scale particles on the silicon substrate and enable direct interface to measurement and computing devices. This paper overviews current efforts along this direction and presents an example design of a platform for sensing and manipulating magnetized beads on its surface using standard silicon CMOS technology. The vision is that such arrays can be easily commanded in nano seconds to realize magnetic field profiles in order to steer magnetized material in the proximity of the platform. Moreover, as technology features decrease, the size of the electromagnetic coil cells in the array would also decrease to nano scale, sharpening the sensing and manipulation resolution of the platforms. [C532]

#### "S-band TCR patch antenna design for nano satellites"

The small satellites offer reduced cost and low mass solutions for various mission needs such as Earth monitoring, scientific experiments, and data communication. Thus the small satellite market grows proportionally as their developing technologies replace the operations of conventional large satellites. Nowadays manufacturers consider small satellites due to their reduced time scale during design and integration phases. In this trend, light weight, reliable antennas with wide radiation patterns and adequate gains have to be employed in small satellites to accomplish telemetry, command, ranging (TCR) functions and high speed payload data transmission. In this study, an S-Band patch antenna design procedure is examined in order to meet the TCR functional requirements in nano satellites. The proposed patch antenna can be utilized for the payload transmission which includes the amateur radio applications and earth monitoring. [C533]

#### "Session MNT: Micro and nano technology 1"

{no data available} [C534]

#### "Integrating biological knowledge, novel imaging modalities, and modeling in breast cancer diagnosis"

Despite tremendous advances in modern imaging technology, both early detection and accurate diagnosis of breast cancer are still unresolved challenges. Today, a variety of imaging modalities and image-guided biopsy procedures exist to identify and characterize morphology and function of suspicious breast tissue. However, a clinically feasible solution for breast imaging, which is both highly sensitive and specific with respect to breast cancer, is still missing. As a consequence, unnecessary biopsies are taken and tumours frequently go undetected until a stage where therapy is costly or unsuccessful. Currently, the exact diagnosis of suspicious breast tissue is ambiguous in many cases. To resolve this, computer aided diagnosis methods are developed which use knowledge extracted from large multimodal case databases. Clinical workstations must be developed to allow clinicians to use additional image modalities in an optimal way. Dedicated tools are required to guide clinicians in establishing a diagnosis, and should ultimately lead to more specific and accurate diagnostic decisions. [C535]

#### "An integrative approach to cerebrovascular disease healthcare: IT for cerebral aneurysms"

One of the central themes in addressing vascular disease is connected with the behavior of the arterial wall; its response to stimuli, its remodeling, the growth or stabilization of lesions and the interaction with implants and drugs. For the case of cerebral aneurysms, we are presenting an effort to embed computational simulation models capable of handling such processes within an IT framework that combines imaging, modeling, genetics and clinical medicine in an integrative and comprehensive fashion. The @neurIST project aims at the development of an IT-enabled patient risk assessment and guidelines generation environment, capable of optimized decision support and treatment design. Within this framework, we present mechanobiological models of the vascular wall that account for the interaction of hemodynamics with vascular wall fiber and cell population and behavior. [C536]

#### "Development of high power Yb:YAG pump source for few-cycle pulse amplification"

Recently few cycle pulses with an ultrahigh peak power and a high average power have been actively developed by using a conventional Ti:sapphire system and an optical parametric chirped-pulse amplification (OPCPA) system. A powerful pump source is enthusiastically desired in nano- and pico-seconds for Ti:sapphire and OPCPA, respectively. A "GENBU (Generation of ENergetic Beam Ultimate)"-laser has been conceptually designed for peta-watt peak power at 100 Hz by using the broadband OPCPA technique. A 100 J pulse energy is necessary as a pump source and a diode-pumped solid-state laser is one of the most promising system, which uses novel technologies of a cryogenic Yb: YAG and an active mirror amplification scheme. A feasibility of the pump source has been studied at sub-joule pulse energy to show its viability of this new laser system. A master-oscillator power-amplifier (MOPA) system has been developed at 150 mJ at 100 Hz in 10 ns. [C537]



### "Electrical transport characterization of nano CMOS devices with ultra-thin silicon film"

The mobility and, more generally, the transport parameters of MOS devices are key quantities for the performance evaluation in advanced CMOS technologies. In this work, a review of the main mobility results obtained in short channel devices (here GAA/DG, FD-SOI MOSFETs and FinFETs) are presented and discussed for better understanding their transport limitations and, in turn, their performances. [C538]

### "Image analysis of Arabidopsis trichome patterning in 4D confocal datasets"

In this article, we present an approach for the automated extraction of quantitative information about trichome patterning on leaves of Arabidopsis thaliana. Time series of growing rosette leaves (4D confocal datasets, 3D + time) are used for this work. At first, significant anatomical structures, i.e. leaf surface and midplane are extracted robustly. Using the extracted anatomical structures, a biological reference coordinate system is registered to the leaves. The performed registration allows to determine intra- as well as inter-series spatiotemporal correspondences. Trichomes are localized by first detecting candidates using Hough transform. Then, local 3D invariants are extracted and the candidates are validated using a Support Vector Machine (SVM). [C539]

### "GPU implementation of map-MRF for microscopy imagery segmentation"

Recent developments in 3D low-light level CCD (L3CCD) image capture have enabled the study of the dynamics of biomedical bodies within cells. This paper firstly presents an improved algorithm for automatic segmentation of such imagery. It allows for the specific nature of noise in L3CCD data. Secondly, the massive volume of data produced by continuous real time 3D scans requires a high performance computation facility for automatic segmentation and tracking. The paper presents details and results of a GPU implementation of a version of the segmentation algorithm, and shows that on an NVIDIA GeForce 8800GTX, coded in CUDA C, the algorithm runs around 550 times faster than the Matlab version of the algorithm running on a PC. [C540]

### "Feature space transformation for semi-supervised learning for protein subcellular localization in fluorescence microscopy images"

As rapid acquisition of large collections of fluorescence microscopy cell images can be automated, large-scale subcellular localizations of GFP-tagged fusion proteins can be practically accomplished. Semi-supervised learning has the potential of using a large set of unlabeled images for the recognition of subcellular organelle patterns, but the performance still has room for improvement. This paper presents a feature space transformation method based on the spectral graph theory to improve semi-supervised learning. Experimental result shows that our feature space transformation method can improve the classification accuracy substantially. [C541]

### "Nano-particles transportation using a holographic multiple-vortex tweezer"

Optical vortex tweezers, providing orbital angular momentum to trapped particles, have been successfully demonstrated to sort and deliver micro-particles on a mesoscopic-scale. They used mostly a single vortex, in which a single phase singularity is involved in a wavefront. A multiple-vortex with several phase singularities in a wavefront is potentially capable of controlling several independent optical traps, each with individually specified characteristics, by using a single laser. In this paper, we demonstrate the transport of nano-particles to a specified direction in a mesoscopic field by utilizing three independent vortices with individually specified rotational speed and direction, computer-generated from a single laser beam, for the first time. We call this system a holographic multiple-vortex tweezer. This system, in which many independent vortices with individually specified rotational speed and direction are produced in a mesoscopic field, can thus be adapted to a wide range of applications, including sub-cellular engineering and macromolecular sorting. [C542]

### "Automatic Positioning Device Design for the Operation Platform of Nano-indentation"

In this paper, we try to measure the differences among the indentations of single crystal bulks under different rotation angles by nanoindentation test. Besides, we also give a design of positioning device for the nanoindentation measuring system. It is driven by stepping motors and relevant circuits for controlling the rotations of the wafer supporting platform. The drive circuit is connected with microprocessors. The rotation angle of the platform can be adjusted by instructions so that the system can be used to carry out nanoindentation tests in different angles for more precise mechanical properties data of the nanoindentation materials. [C543]

### "Fabrication of Microlens Arrays by Using Nano-Particle Fluid Imprinting Technology"

In this study, we look into an innovative technology which utilizes nano-particles as a medium for imprinting. This



technology integrates the advantages of soft lithography, photo-cure resist, and gas assisted imprinting. We try to produce micro-lens arrays by gas-assisted nano-particles based soft mould imprinting on photo-cure resists. It helps the application and technology of nano-imprinting becoming more sophisticated. We find that PDMS can be used to precisely replicate micro-to-nano-meter level micro-structures. Together with nano-particles and well-proportioned gas pressure, we can construct a perfect shape of micro-structures and achieve a conformal contact with the surface of base material. It increases the effective imprinting area significantly and improves the replication capability of the transfer. Meanwhile, the PDMS soft mould is easy for production and fast in replication, which reduces the cost remarkably. Furthermore, it has a low surface free energy and low viscosity to the resists. Integrating gas assisted nano-particles imprinting can be a great advantage in the process of micro-structure. [C544]

#### **"A Novel Magnetic Nickel Mold Combined Nano-Particle Fluid Electromagnetism Imprinting on Replicating Microstructures"**

This study proposes a novel technology using nano-particle fluid electromagnetism to control the direct hot imprint resist of nickel mold. Combining the present gas-assisted nanoparticle hot imprint molding technology, electroforming technology, and self-designed heatable electromagnetic plate for even control and progressive pressuring technology, this study used electromagnetic nickel mold direct hot imprint to replicate micro structures, in order to make the molding technology and application of micro nanoimprint more mature. This study first used gas-assisted nanoparticle hot embossing method to replicate structures of microlens of original silicon molds on PC, so as to obtain complementary structural patterns. This PC film with structures of microlens is cast into nickel molds by electroforming. This nickel mold was used as the mold for magnetic embossing to imprint hot plastic PMMA. The result showed that through gas-assisted nanoparticle hot embossing molding, casting and component magnetic PDMS soft mold casting, molds of high costs and complicated production process can be massively replicated, and the replication precision is good. Hot gas embossing PDMS film and the surface of base materials can achieve even pressure and conformal contact, thus significantly improving the effective imprint area and imprintability. Through electroforming, casting duration of magnetic nickel molds can be shortened and costs can be effectively lowered. Moreover, electromagnetic plate was used to evenly control the direct hot pressure imprint resist, which is an advantage of the production process of micro structures. [C545]

#### **"Large random telegraph noise in sub-threshold operation of nano-scale nMOSFETs"**

We utilize low-frequency noise measurements to examine the sub-threshold voltage (sub-V<sub>TH</sub>) operation of highly scaled devices. We find that the sub-V<sub>TH</sub> low-frequency noise is dominated by random telegraph noise (RTN). The RTN is exacerbated both by channel dimension scaling and reducing the gate overdrive into the sub-V<sub>TH</sub> regime. These large RTN fluctuations greatly impact circuit variability and represent a troubling obstacle that must be solved if sub-V<sub>TH</sub> operation is to become a viable solution for low-power applications. [C546]

#### **"Femtosecond micromachining of high aspect ratio structures in fused silica using Bessel beams"**

Femtosecond laser micromachining is a laser processing technology with proven potential for the fabrication of a wide range of photonic devices. In the context of developing integrated components for microfluidics, a key issue is the machining of high aspect ratio micro and nano-channels, and the use of diffraction-free Bessel beams for this purpose has attracted much attention. However, although Bessel beams possess several attractive characteristics for this purpose, we show here that their practical use for high aspect ratio micromachining requires a careful selection of focussing and pump laser parameters. We report results of a systematic study of Bessel beam micromachining of structures of diameter < 5 μm in fused silica, and we describe conditions under which high quality and high aspect ratio structures can be reproducibly obtained. Within the parameter regimes identified here, Bessel beams present quantitative advantages when compared to diffractive Gaussian beams, especially for the drilling of channels of sub-10 μm diameter. Outside this parameter regime, there is little benefit in the Bessel beam approach. [C547]

#### **"Speckled Computing: Evolution and Challenges"**

Speckled computing is an emerging technology in which data will be sensed in a minute, ultimately around one cubic millimeter, semi conductor grain called speck. Wireless network of thousands of specks called SpeckNet and distributed processing of information on programmable network is termed as Speckled Computing. Specks are not new, but the re-design of sensor nodes at nano scale. These nodes will operate with out any fixed infrastructure and are intended to be deployed in large quantity to increase overall throughput of the system. Furthermore specks can be deployed to places that are difficult to reach. These important features impose various requirements on specks. This paper begins with brief overview of speckled computing and continues with discussion on the evolution of sensor technology along with key research projects. This paper also reviews key



challenges related autonomic and ad hoc nature of specks. [C548]

### "The place of small satellites in fulfilling the Earth observation requirements of a developing country"

Of the three or four major areas of use of satellites, Earth observation is probably the most attractive one for non-space-faring countries, in their aspirations to step into the space age. The expressed purpose to make use of space technologies for the benefit of the country covers both acquiring regional terrain data needed for development, and starting to build the infrastructure for further space efforts. Although building of remote sensing spacecraft may require a lower level of technology and a lower cost than communication or navigation satellites, the technical barriers and economic feasibility have still been too high for most developing countries to start a program of building observation satellites. Thus remote sensing still has been largely the realm of a few countries which have also dominated the commercial market for Earth imagery. All that may be changing though in recent years with declining cost and size as well as more widely available electronic and sensor technologies. Ever smaller sizes, that is, micro, nano and pico satellites not only make it easier to build a satellite but also make it more affordable. The trend toward smaller satellites is also visible in well advanced space faring countries because the same mission objectives can be achieved more quickly and at a lower cost. This paper reviews the small satellite developments and lays out some proposals for fulfillment of the Earth observation requirements of developing countries using small satellites. The proposals involve the capabilities and the numbers of small satellites, in regard to the requirements of resolution, revisit frequency, spectral bands and most importantly the economics. This paper should be especially meaningful for a country like Turkey which has a large area for natural resources monitoring and development, as well as a sensitive geopolitical position which makes it important to observe the region for security and defense. [C549]

### "Improving technology for molecular imaging with ultrasound"

Ultrasonic molecular imaging is a nascent field where the application of targeted contrast agents permits assessment of molecular changes in physiology. This is in contrast to the traditional anatomical imaging applications of ultrasound. To date, ultrasonic molecular imaging has shown promise in detecting molecular markers associated with angiogenesis, inflammation, and thrombus. However, this new modality has been only slowly advancing, and is still largely limited to studies in animal models. This conference proceeding reviews several challenge areas where our group is improving technology to facilitate ultrasonic molecular imaging. [C550]

### "Yes, we can improve SoC yield"

With the technology entering the nano dimension, manufacturing processes are less and less reliable, thus drastically impacting the yield. To address this problem during SoC development, memory cores are built with hardware redundancies. On the other hand, logic cores embedded in SoC usually do not have such redundancy capabilities. Therefore, manufacturing defects affecting these cores decrease the yield of the entire SoC. Consequently, meaningful techniques for SoC yield improvement must also consider logic cores. In this paper, we propose and investigate the usage of TMR architectures for logic cores to increase the overall SoC yield. In order to analyze the TMR effectiveness, we resort to two defects distribution models, the Poisson and negative binomial distributions, that are also compared. Results obtained on SoC examples demonstrate the interest of using TMR architectures for SoC yield enhancement purpose. [C551]

### "Guiding principles toward future gate stacks given by the construction of new physical concepts"

Recent LSI technologies require the introduction of a wide variety of materials and structures in addition to conventional aggressive down-scaling. As a result, present semiconductor devices contain various kinds of nano-scale interfaces and nano-structures. In this paper, we show that conventional physics concepts cannot be applied directly to these interfaces or structures and that construction of new physical concepts is crucial for establishing guiding principles toward future LSIs. In fact, we have succeeded in controlling effective gate work functions of high-k gate stacks based on our new interface physics concepts of "Oxygen vacancy induced Fermi level pinning". Moreover, we also propose guiding principles toward future Si nanowire (NW) FET based on atomic and electronic structures of Si NW. [C552]

### "Distribution of Antioxidatases in Cell of Diatom Nitzschia Closterium and Response to Different Environmental Silicon Concentrations"

The outbreak mechanism of red tide and the rapid reproducing mechanism of red-tide species are not very clear so far. Diatom is one of the main red tide microalgae species. It can utilize the environmental silicon to



biosynthesize its nano-silicon cell wall, so its growth and reproduction are closely related to the absorption and bioaccumulation of environmental silicon. Therefore, study on the response of diatom to the environmental silicon will have important significance in the exploration of the outbreak mechanism of red tide caused by diatom. Antioxidases have been reported to have close relationship with the accumulation of silicon. Therefore, the present paper studied the distribution of the four antioxidantases--polyphenoloxidase (PPO), superoxide dismutase (SOD), peroxidase (POD) and catalase (CAT) in the diatom *Nitzschia closterium*, and their response to environmental soluble silicon. The results showed that PPO, SOD and POD were found in the diatom *Nitzschia closterium*. PPO distributed only in the plasma membrane, POD distributed only in the cytosol, and SOD distributed in both the plasma membrane and the cytosol. But SOD activity in the plasma membrane was much higher than that in the cytosol. After the diatom were cultivated in the low Si culture (10 mg/L), high silicon culture (100 mg/L) and normal silicon culture (30 mg/L, control ) for 12 days respectively, the plasma membranes of the diatom were extracted and purified by two-phase method, and the activities of SOD and PPO were analyzed. The results showed that the two antioxidantases in the low Si culture were not remarkably different from those in the control, but they were significantly inhibited in the high Si culture ( $p < 0.05$ ). [C553]

#### "Fabrication and Characterization of Micro Opto-electronic Sensor"

Tunneling junction is the basic structure of photoconductive semiconductor switch (PCSS) and single electric transistor (SET). In order to get ultra high speed PCSS, photo lithography and AFM nano oxidation methods are combined to fabricate micro metal (Ti)-insulator (TiOx)-metal (Ti) tunneling junction (MIM) type PCSS. Multi-junctions structure is tried to enhance the PCSS's photoelectric efficiency. The I-V characteristics, such as effect of TiOx wire width on tunneling and effect of TiOx wire's number on Tunneling of the tunneling junctions, are studied and analyzed in this paper. The results indicate that there is a clear exponential relationship between tunneling current and bias voltage and that different TiOx wire width and different numbers of TiOx wires induce different tunneling phenomena. [C554]

#### "Electronics and its impact on energy and the environment"

Technology's impact on human health has been a concern for at least 200 years. These concerns ranged from the waste and pollution due to mining and heavy manufacturing to emissions from the automobile and fossil fuel power plants. Now the proliferation of electronics products, their manufacture and disposal are posing additional threats to the fragile balance of the Earth's eco systems. Nevertheless, electronics can also be the solution to many of our current and future environmental and energy related problems. The environmental threats from electronics can be significantly reduced or eliminated through consciously environmentally responsible choice of materials, technology, design, manufacture, distribution, usage, and end-of-life disposal. In a similar way the application of electrical and electronics technologies and devices for power generation, electric and hybrid automobiles and solid-state lighting can significantly positively contribute to reducing mankind's carbon footprint and improve our environment. Thus, consciously and demonstrably, electronics technologies, devices and applications are making major contributions through the removal of toxins and pollutants; innovative materials enable reduction in use of other materials; new electronics energy sources will become the long-term major sustainable sources; solid state lighting is decreasing the consumption of energy whilst providing improved illumination. Nano-electronics products now enable more efficient use of energy in many walks of life. [C555]

#### "Synthesis of zinc oxide nanotiles by wet chemical route assisted by microwave heating"

In this paper a wet chemical synthesis of zinc oxide assisted by microwave heating was investigated. Two starting solutions of ZnCl<sub>2</sub> and NaOH were mixed under different conditions. Then obtained mixture was heated in microwave reactor. Products of reaction were investigated under scanning electron microscope. Results shown that obtained white powder is crystallized nanostructures build from nano- and microscale hexagonal tiles. This structures have hierarchical constitution, where tiles create organized systems in shape of pyramid. This highly build up active surface area can be used to enhanced sensitivity and reaction time of semiconductor gas detectors. [C556]

#### "Design of digital display system for ISFET pH sensor by using PIC microcontroller Unit (MCU)"

This paper describes the digital display system using peripheral interface controller (PIC) microcontroller. The research is conducted in-house at the university microelectronic and nanotechnology research cluster well equipped with electrical instruments and electronic equipments. This paper focuses on the design of schematic circuit for digital display system using PIC microcontroller and development of programming for PIC microcontroller. Digital display system is the most popular technology and most compatible with the embedded system devices. The system is a variable device that is easily adapted to a wide range of agriculture, chemical, biochemical and biomedical measurements. The operation of this system is based on the analogue value in term



of electrical conducted by ionic sensitive field effect transistor (ISFET) pH sensor and display the captured data using PIC microcontroller. As a result of this process, the threshold voltage of the ISFET is modulated and it will be converted as the value of pH on digital display system. This paper also highlights the research on ISFET and deals with the fundamental issue: fabrication of ISFET using CMOS technology. The ISFET compatible layout will be presented and the ISFET process flow will be discussed. [C557]

### **"P2P in public health: From particles to populations"**

Despite numerous changes introduced by the new technologies, the role and the meaning of public health within health has remained stable and important. Public health is also expanding from the strictly population-focus to genetics and nano-technology. This means that the fundamentals of public health need to be supplemented by the additional expertise in areas such as medical informatics, bioinformatics, genetic epidemiology and public health genomics. The first step in integration is to develop the means of joining these ideas and experts in the solving of multidisciplinary problems, aiming to supplement public health with the emerging new technologies, ideas and concepts. [C558]

### **"Fixed gantry tomosynthesis system for radiation therapy image guidance based on a multiple source x-ray tube with carbon nanotube cathodes"**

We present the design and simulation of a multiple source X-ray tube based on carbon nanotube cold cathode technology. The primary intended application is tomosynthesis-based 3D image guidance during external beam radiation therapy. The tube, which is attached to the gantry of a medical linear accelerator (linac) immediately below the multileaf collimator, operates within the voltage range of 80-160 kVp and contains a total of 52 sources that are arranged in a rectilinear array. This configuration allows for the acquisition of tomographic projections from multiple angles without any need to rotate the linac gantry. The X-ray images are captured by a standard amorphous silicon flat panel portal imaging device. The field-of-view (FOV) of the system corresponds to that part of the volume that is sampled by rays from all sources. The present tube and detector configuration provides an 8 cm times 8 cm FOV in the plane of the linac isocenter when the 40.96 cm times 40.96 cm imaging detector is placed 40 cm from the isocenter. Since this tomosynthesis application utilizes the extremities of the detector to record image detail relating to structures near the isocenter, simultaneous treatment and imaging is possible for most clinical cases, where the treated target is a small region close to the linac isocenter. The tomosynthesis images are reconstructed using the simultaneous iterative reconstruction technique (SART), which is accelerated using a graphics processing unit (GPU). We present details of the system design as well as simulated performance of the imaging system based on reprojections of patient CT images. [C559]

### **"Photoacoustic tomography: High-resolution imaging of optical contrast in vivo at superdepths"**

A photoacoustic imaging technology for in vivo early-cancer detection and functional imaging is developed by physically combining non-ionizing electromagnetic and ultrasonic waves. An ultrasound-mediated imaging modality is devised by combining electromagnetic and ultrasonic waves synergistically to overcome the above limitations. The hybrid modalities provide relatively deep penetration at high ultrasonic resolution and yield speckle-free images with high electromagnetic contrast. [C560]

### **"The role and development of technology to advance brain science"**

Our methods and models, calculations and cautions are relevant to brain science only when coupled with the principles and current state of neuroscientific knowledge and its underlying physics, chemistry and clinical utility. Increasing numbers of technical scientists interested in contributing their talents to brain science are taking the time and effort to learn its fundamental concepts and latest results, and many neuroscientists are becoming more familiar with the strengths and weaknesses of technical methods, working together to design and conduct the best studies that are scientifically possible. [C561]

### **"Biomedical imaging ecosystem and the role of the GPU"**

The biomedical imaging chain is continuously being challenged to reconstruct, analyze, and visualize increasing amounts of data in shorter amounts of time. Parallel computing on multi-core devices and clustered computers has allowed for continued innovation of compute and processing technologies but not without facing serious constraints of cost, space, and power consumption. Over the last three years the graphics processing unit (GPU) and its increased programmability has played an integral role in defining a new dimension to parallel computing with its single chip, many-core architecture as well as evolving the graphics pipeline to enhance visualization techniques. Image reconstruction, segmentation and registration algorithms architected to take advantage of the GPU parallel architecture not only realize massive processing speedups but also set the stage for scalability. High resolution rendering of 3D and 4D datasets are navigated in interactive, real-time approaches. Real time



ray tracing and 3D stereoscopic solutions bring increased realism to images. Understanding the optimized mix of GPU and CPU, both in the sense of hardware and software, is necessary for imaging applications to innovate, realize cost/performance efficiency and continue to enhance visualization. Several approaches for GPU programmability are available and will be explored. Innovations in the compute, graphics and visualization space will be discussed to show the relevance of the GPU throughout the imaging chain. [C562]

### "Topology Optimization of a Three-Dimension Compliant Microgripper Using Multi-objective Compliance"

Micro and nano positioning stages are critically important to both the mechanical and electronic industries. Gripping micro objects are required for a wide range of important applications such as the assembly of micro-parts to obtain miniature systems or component assembly in electronics packages. An effective mechanical micro and nano manipulator should possess the ability to grasp objects of different shapes steadily with high positioning accuracy. A microgripper compliant mechanism is one of the key elements in micro-robotics and micro-assembly technologies for handling micro-objects without damage. Compliant mechanisms can play an important role in the design of micro-devices for micro-electro-mechanical systems (MEMS) applications. Compliant mechanisms are flexible structures, which can generate the desired motions by undergoing elastic deformation instead of through rigid linkage/joints as in rigid body mechanisms. The topology optimization methods search for an ideal material distribution of a structure. In this paper, topology optimization method is applied for designing a three-dimension compliant microgripper mechanism. The optimal topology configuration of the compliant microgripper mechanism is demonstrated. This compliant mechanism can be used to handle a wide range of micro and nano objects up to 400  $\mu\text{m}$ . [C563]

### "Localizing the dermis/epidermis boundary in reflectance confocal microscopy images with a hybrid classification algorithm"

Confocal reflectance microscopy is an emerging modality, for dermatology applications, especially for in-situ and bedside detection of skin cancers. As this technology gains acceptance, automated processing methods become increasingly important to develop. Since the dominant internal feature of the skin is the epidermis/dermis boundary, it has been chosen as the initial target for this development. This boundary is a complex corrugated 3D layer marked by optically subtle changes and features. Indeed, even trained clinicians in an attempt at validation of our early work, were unable to precisely and reliably locate the boundary within optical resolution. Thus here we propose to detect two boundaries, a lower boundary for the epidermis and an upper boundary for the dermis thus trapping the epidermis/dermis boundary. We use a novel combined segmentation/classification approach applied to z-sequences of tiles in the 3D stack. The approach employs a sequential classification on texture features, selected via on-line feature selection, to minimize the labeling required and to cope with high inter- and intra-subject variability and low optical contrast. Initial results indicate the ability of our approach to find these two boundaries successfully for most of the z-sequences from the stack. [C564]

### "Profile-guided optimization of critical medical imaging algorithms"

Given the rapid growth in computational requirements for medical image analysis, Graphics Processing Units (GPUs) have begun to be utilized to address these demands. But even though GPUs are well-suited to the underlying processing associated with medical image reconstruction, extracting the full benefits of moving to GPU platforms requires significant programming effort, and presents a fundamental barrier for more general adoption of GPU acceleration in a wider range of medical imaging applications. In this paper we describe our experience in accelerating a number of challenging medical imaging applications, and discuss how we utilize profile-guided analysis to reap the full benefits available on GPU platforms. Our work considers different GPU architectures, as well as how to fully exploit the benefits of using multiple GPUs. [C565]

### "Performance evaluation of CNFET-based logic gates"

As the physical gate length of current devices is reduced to below 65 nm, effects (such as large parametric variations and increase in leakage current) have caused the I-V characteristics to be substantially depart from those commonly associated with traditional MOSFETs, thus impeding the efficient development and manufacturing of devices at deep submicro/nano scales. Carbon Nanotube Field Effect Transistors (CNFETs) have received widespread attention, as one of the promising technologies for replacing MOSFETs at the end of the Technology Roadmap. This paper presents a detailed simulation-based assessment of circuit performance of this technology and compares it to conventional MOSFETs; the designs of different logic gates and the full adder circuit are simulated under the same minimum gate length and different operational conditions. It is shown that the power-delay product (PDP) and the leakage power for the CNFET based gates are lower than the MOSFET based logic gates by 100 to 150 times, respectively. The CNFET based logic gates demonstrate good



functionality even at a 0.3 V power supply (while MOSFET based gates fail at 0.5 V). [C566]

### "Microwave permittivity and permeability properties and microwave reflections of micro/nano ferrite powders"

The application of magnetic powders are becoming attractive in electromagnetic shielding interferences in wireless systems. Magnetic powders such as  $\text{Fe}_3\text{O}_4$  are also very important in magnetic resonance imaging as well as drug delivery applications in biomedical researches. Also, some of the special catalyst nano magnetic particles are increasingly useful in the fuel cell applications. Hence, a good understanding of the electromagnetic wave response such as permittivity and permeability of magnetic powders may be important in modern microwave technological applications. In this paper we present broad-band measurements on the real and imaginary parts of permeability and permittivity of micron sized commercial nickel ferrites of  $\text{Ni}_{1-x-y}\text{Co}_x\text{Cu}_y\text{Fe}_2\text{-z-dMn}_z\text{O}_4$  (TT2) and  $\text{Ni}_{1-x}\text{Zn}_x\text{Fe}_2\text{-yMn}_y\text{O}_4$  (TT86) in the frequency range from 4 to 40 GHz. We also present broadband permeability and permittivity of some other commercially available nano and micron sized ferrite powders, so that this is a paper that explores microwave properties of nine different nano and micron sized magnetic powders in terms of permittivity and permeability aspects. [C567]

### "AlN contour-mode resonators for narrow-band filters above 3 GHz"

This paper reports on the design and experimental verification of a new class of thin-film (250 nm) super high frequency (SHF) laterally-vibrating piezoelectric microelectromechanical (MEMS) resonators suitable for the fabrication of narrow-band MEMS filters operating at frequencies above 3 GHz. The device dimensions have been opportunely scaled both in the lateral and vertical dimensions in order to excite a contour-extensional mode of vibration in nano features of an ultra-thin (250 nm) aluminum nitride (AlN) film. In this first demonstration two-port resonators vibrating up to 4.5 GHz were fabricated on the same die and attained electromechanical coupling,  $k_t^2$ , in excess of 1.5 %. These devices were employed to synthesize the highest frequency ever reported MEMS filter (3.7 GHz) based on AlN contour-mode resonator (CMR) technology. [C568]

### "Probabilistic analysis of design mapping in asynchronous nanowire crossbar architecture"

There have been numerous nanowire crossbar architectures proposed till date and they are envisioned as clock-driven. To deal with numerous issues caused by clocking, a new asynchronous architecture based on Null Convention Logic (NCL) has been recently proposed, resulting in the removal of the clock circuit overhead from the crossbar architecture. The proposed architecture is easier to be manufactured and all clocking-related issues are also eliminated. Even though the proposed architecture has considerable merits over its clocked counterpart, it is still prone to defects due to nondeterministic nature of nanoscale assembly and the defect density is directly proportional to the density of nanowires in the architecture. Hence a number of ways are being examined to effectively avoid the defects to make the architecture defect tolerant. Considering the fact that the nano crossbar architecture has a large number of defects due to manufacturing constraints and its extremely small size, the variations in mapping probabilities with certain factors, such as defect rate, size of crossbar matrix, and type of threshold gate are numerically measured to get an optimized design for resilient clock-free nanowire crossbar systems. [C569]

### "T<sub>g</sub> : The glass door to photonic devices and integrated circuits"

An emerging technology which shows promise for the fabrication of glass photonic integrated circuits (PICs), is sub-micron-scale embossing or imprinting. This approach makes use of T<sub>g</sub> (the glass transition) which gives inorganic compound glasses a key advantage over crystalline materials for fabricating photonic devices and PICs. Thus, on heating the glass above T<sub>g</sub> the supercooled liquid temperature regime is accessed which enables shaping, e.g. moulding, to be carried out. Cooling back down through T<sub>g</sub> allows the shaping to be retained in the glassy state. In this way, glasses may be shaped from the macro-scale e.g. to make light-refracting lenses down to the nano-scale e.g. for waveguides or photonic crystal arrays for dispersion management. Hence T<sub>g</sub> is one door to making photonic devices. This claim will be illustrated by reviewing both the background methodology and our recent work on hot embossing of inorganic compound glasses to make waveguides. Opportunities and potential pitfalls will be highlighted. [C570]

### "Nano-materials and nano-technologies for novel photon detection systems"

The transition from macro to micro-sensor systems in the last decades has been made possible by the use of silicon and by development of micro-technology. Semiconductors opened the door to the realization of sensors based on Very Large Scale Integration Systems in which the external information is transduced into an electrical signal managed directly inside the micro-devices by the use of microelectronics. Up to now, the most powerful integrated systems may be considered the Medipix chip for medical imaging and avalanche photodiodes



operated in Geiger mode (SiPMs) for photon radiation detection. A similar transition from micro to nano is now knocking at the door. New nanotechnologies allow the realization of finely pixelled surfaces and manipulation of nano-structured materials at a few nanometer scales. Sensors can be created by flipping from a top-down process to a bottom-up approach. To do this, one must develop new materials having similar electrical properties of silicon but chemical properties appropriate for a bottom-up building process. Among the wide variety of materials which can be managed with nano-technological processes, Carbon Nanotubes (CNT) dominate for their unique mechanical and electrical characteristics. They can be grown chemically in a very easy and cheap way, assembled in the desired geometry by means of nano-lithography and directly connected to readout electronics devices. In addition, they can be coupled to silicon substrates to obtain mixed micro-nano structures with intermediate electronic properties. First radiation detectors prototypes have been realized using CNTs grown through a CVD (Chemical Vapour Deposition) process. These devices, sensitive to the radiation in the range from 335 to 850 nm, exhibit a relevant increase in the photocurrent toward UV wavelengths both with continuous light and with pulsed radiation. The surface pixelization can be easily achieved using nano-lithography techniques at a very low cost. This approach looks very promising also for the realization of nano-opto-electronic devices directly coupled with readout electronics as in the Medipix chip. In this talk, we propose a review of results obtained by the authors with detector prototypes made of multiwalled carbon nanotubes grown on sapphire and silicon substrates. Electrical and optical properties of detectors have been intensively studied as well as the coupling between nanotubes and silicon substrates. The strong matching between silicon and CNTs found suggests the possibility to realize a finely pixelled large area detector, UV sensitive, with submicron position accuracy. [C571]

#### "New probe immobilizations by lipoate-diethalonamines or ethylene-glycol molecules for capacitance DNA chip"

Label-free DNA detection is of crucial role to when developing point-of-care biochips to be used in personalized therapy. Capacitance detection is a promising technology for label-free DNA detection. However, data published in literature often show evident time drift, large standard deviation, scattered data points, and poor reproducibility. To solve these problems, alkanethiol molecules such as mercapto-hexanol are usually considered as blocking agents. The aim of the present paper is to investigate new blocking agents to further improve DNA probe surfaces. Data from AFM, SPR, fluorescence microscopy, and capacitance measurements are used to demonstrate the new lipoates molecules. Moreover precursor layers obtained by using Ethylene-glycol alkanethiols offer further improvements in terms of diminished detection errors. Film structure is investigated at the nano-scale to justify the detection improvements in terms of probe surface quality. This study demonstrates the superiority of lipoate and Ethylene-glycol molecules as blocking candidates when immobilizing molecular probes onto spot surfaces in label-free DNA biochip. [C572]

#### "Novel fast neutron counting technology for efficient detection of special nuclear materials"

Results from a fully independent thin film process for manufacturing non-lead glass Microchannel plate (MCP) detectors using nano-engineered thin films for both the resistive and emissive layers are presented. These novel MCP devices show high gain, less gain degradation with extracted charge, and greater pore to pore and plate to plate uniformity than has been possible with conventional lead glass structures. Extension of MCP to plastic substrates, for the purpose of fast neutron detection is disclosed and preliminary MCP functionality results are presented. Simulation results, predicting fast neutron detection performance for the plastic MCP device are presented and discussed. [C573]

#### "Study on Leaching Mechanism of Micro/Nano Particles from Cunninghamia lanceolata Wood in NaOH Liquor"

In order to overcome the above-mentioned negative effects, the extractives of the fresh Cunninghamia lanceolata shavings, which were obtained by using both the sorbitic-extracting approaches, were analyzed by ZETA and SIZER to find out the leaching rule of nano particles in Chinese-fir wood. The results are as follows: (1) The extraction mass arrived at the maximum value when NaOH concentration is about 18.5. The micro/nano particles in Cunninghamia lanceolata shavings would be discharged sufficiently in the NaOH solution with the increasing of extracting time. (2) The diameter the micro/nano particles of wood extractives and hemicellulose is chiefly between 24.4-1720 nm according to volume fraction when NaOH concentration is <10%. And the diameter the micro/nano particles of wood extractives and hemicellulose is chiefly between <342 nm according to volume fraction when NaOH concentration is <10%. Micro/nano particles in the diameter of 24.4-91.3 nm, 342-1720 nm, 0-24.4 nm is the most at the extracting time of 3 h, 16 h, 24 h, respectively. (3) The diameter the micro/nano particles of wood extractives and hemicellulose is chiefly between 24.4-1720 nm according to number fraction. Micro/nano particles in the diameter of 91.3-342 nm, 91.3-342 nm, 91.3-1720 nm is the most at the extracting time of 3 h, 16 h, 24 h, respectively. [C574]



### "Principle and Realization of Nano-Molecular Probe in Molecular Imaging Technologies"

Nano-molecular probe technology is the key part of the molecular imaging technologies, also a bottleneck part that decides the molecular imaging technique development. Firstly, the article discusses the property of the nanoparticles carrier and the target tropism of the modified molecule. Then mainly presents the self emulsion/solvent evaporation technique to synthesize nano-molecular probe. Finally analyzes the factors which will affect the synthesizing of the nano-molecular probe. [C575]

### "Research on Characterization and Biocompatibility of Bacterial Cellulose Tissue Engineering Scaffold"

Bacterial cellulose (BC) tissue engineering scaffold, possessing nano-fiber, an ultrafine 3-dimensional network and proper porosity, has been prepared by static culture of *G. xylinus*. It has been characterized by scanning electron microscope (SEM), atomic force microscope (AFM), and light microscope. The pore size of BC is 0.6 to 2.6 micrometers (μm) and the width of cellulose ribbon is 50 to 80 nanometers (nm). By measuring their dry weight and wet weight, the porosities of air-dried BC and freeze-dried BC have been determined to be around 70% and 90% respectively; the excellent permeability of freeze-dried one has also been found to be better than PVC and PE film. The results show that it has extremely fine network of nano-structure, and the water vapor permeability is quite excellent. Cultured with fibroblasts (FBs) and chondrocytes respectively and subcutaneous transplantation of FBs-BC composition, we find that BC is suitable for cell attachment and proliferation, and shows better cell compatibility. It is expected to become a potential tissue engineering scaffold. [C576]

### "Study on Purification Technique of Biological Chinese Herbal Medicine in Micro/Nano Particles of Chinese-fir Cells"

In order to purify biological Chinese herbal medicine from wood extractives and hemicellulose at the molecular level, the fresh Chinese-fir cells were extracted in LiOH solution, and were analyzed by ZETA and SIZER to find out the leaching rule of nano particles in Chinese-fir cells. The results are as follows: (1) The extraction mass arrived at the maximum value when LiOH concentration is about 17.5%. (2) The diameter the micro/nano particles of wood extractives and hemicellulose is chiefly about 1720 nm according to volume fraction. Micro/nano particles in the diameter of 24.4-91.3 nm, 342-1720 nm, 0-24.4 nm is the most at the extracting time of 3 h, 16 h, 24 h, respectively. (3) The diameter the micro/nano particles of wood extractives and hemicellulose is chiefly between 913 nm and 1720 nm according to number fraction. Micro/nano particles in the diameter of 91.3- 342 nm, 91.3-342 nm, 91.3-1720 nm is the most at the extracting time of 3 h, 16 h, 24 h, respectively. [C577]

### "Polyacrylonitrile/Kaolinite Hybrid Nanofiber Mats Aimed for Treatment of Polluted Water"

The present study provides the methods of preparing organic/inorganic hybrid nanofiber mats. A simple process was developed in preparing polyacrylonitrile/kaolinite hybrid nanofiber mats based on electrospinning technology. The electrospinning of sub-nano kaolinite particles-contained PAN suspensions resulted in uniform distribution of kaolinite particles among the PAN nanofibers, which was demonstrated by scanning electron microscope and optical polarized microscope. However, FTIR results indicated that some interactions between PAN and kaolinite existed, which was useful for the stability of kaolinite-contained suspensions and the even distribution of kaolinite in the PAN nanofiber mats. The as-prepared hybrid nanofiber mats may find well applications in the treatment of phenol polluted water and heavy metal polluted water. [C578]

### "Energy efficient high speed CNFET based interconnect drivers for FPGAS"

Carbon nanotube field effect transistors (CNFETs) are already competitive in some respects with state-of-art silicon transistors, and are promising candidates for future nano-electronic devices. The ability of CNFET for using high K-dielectric provides high insulator capacitance which improves the gate control and also lowers gate leakage. This paper proposes new energy efficient CNFETs based drivers operating in the ballistic mode, for the routing interconnects of FPGAs. HSPICE simulation based on BPTM (Berkeley predictive technology model) for 32 nm channel length device at operating frequency of 500 MHz shows that the scaled CNFETs drivers provides very good performance even at lower supply voltage for interconnect length of 1000 μm. The paper shows that the different schemes of CNFETs based optimized-drivers operating at VDD=0.3 v are more energy efficient than the driver operating on VDD=0.9 v. [C579]

### "Synthesis of Eco-Friendly Ionic Liquids by Microwave Irradiation and Their Applications in Michael Addition"

A mild, efficient and eco-friendly procedure for the synthesis of novel ionic liquids (ILs) with formula (C<sub>4</sub>H<sub>9</sub>)<sub>4</sub>NX-



nC<sub>6</sub>H<sub>11</sub>NO (X=C-, Br-and Ac-, n=2-3) under microwave irradiation and solventless conditions has been investigated. The materials have been characterized by IR, <sup>1</sup>H NMR methods. The properties of this kind of ILs have been researched including the melting point, the viscosity, the solubility, the pH value and the conductivity. Further, these ILs have been exploited for the synthesis of Michael addition using nano-KF/Al<sub>2</sub>O<sub>3</sub> as catalyze in short duration of time with quantitative yields, for the first time. [C580]

### "Non linear optical properties of nanostructured metallic surfaces"

Nano-patterned metal surfaces on dielectric substrates are become very important in nanoscale optical devices such as molecular sensors, second harmonic emitters, negative index materials. Among these, self-organised approaches are a promising alternative to the conventional lithographic or scanning lithography methods, since allow low cost patterning of large macroscopic surface in a single step event. The possibility to construct tailored artificial nanostructures by acting on simple experimental parameters opens new exciting possibilities in the nanoscale technology. In this work we explored the second harmonic emission properties in transmission of self-organized gold nanowires on dielectric substrates. Second harmonic emission from thin metal surfaces is limited by several constrains: for example the emission is forbidden at normal incidence and the emission is always polarized along the plane of incidence of the pumping light. In our samples selected morphology allows to overcome such constrains leading to high emission at normal incidence, polarization of the emission guided by the wires orientation. The angular dependence of the generation efficiency was measured on test samples whose thicknesses of the wires range from 5 nm to 40 nm. The efficiency results of a value larger with respect to samples with equivalent thickness and different morphology. [C581]

### "A Potential Useful Method for Calculating Relative Safety Index of Nanoparticles"

Toxicity of nanomaterials has been assessed by a number of ways, but nano-toxicity standards for biosafety or environment safety have not been established worldwide. It is likely that the final "standard approaches" shall include several components such as cytotoxicity, animal organ injury and body clearance of nanoparticles, while perturbed DNA replication fidelity resulted from nanomaterials is a particular point worthy of investigation for long-term toxicity assessment. This study reported a useful method to calculate the relative capacities of different nanoparticles to introduce DNA replication errors in the rpsL gene-based assays both in vitro (polymerase chain reaction, PCR) and in vivo. The method also offers a platform to develop various technologies in the context of DNA-nanoparticle interactions. [C582]

### "Detection of Biocompatibility between Nano-Layered Double Hydroxides and Hela Cells"

In the past decade, rapid development happened in the field of nanotechnology. Recently, nano-material, especially inorganic hybrid molecule, has become an increasingly hot issue in medicine area for safe drug delivery system. In this paper, nano-layered double hydroxides (nano-LDHs) were chosen to be a potential drug carrier. In order to explore the biocompatibility of nano-LDHs with Hela cells, a single cell gel electrophoresis and H<sub>2</sub>DCF-DA fluorescent coloration assay were used to analyze the DNA damage and the change of reactive oxygen species (ROS) in Hela cells exposed to nano-LDHs. Results showed that, with the increase of concentrations of nano-LDHs (0~800 μg/mL), the Tail DNA%, Tail Moment and ROS contents in Hela cells increased gradually; there were significant differences ( $p < 0.05$ ,  $p < 0.01$ ) in those parameters between high concentration groups (200, 400, 800 μg/mL) and the control group, while no significant differences ( $p > 0.05$ ) were found between low concentration groups (50, 100 μg/mL) and the control. The results suggested that the low concentration nano-LDHs (les 100 μg/mL) had a good biocompatibility with Hela cells, indicating that nano-LDHs may be applicable in medicine. [C583]

### "Effect of KOH Extraction on Micro/Nano Particles of Wood Extractives and Hemicellulose Leaching from Chinese-fir Wood"

In order to overcome the above-mentioned negative effects, the fresh Chinese-fir shavings were extracted in KOH solution, were analyzed by ZETA and SIZER to find out the leaching rule of nano particles in Chinese-fir wood. The results are as follows: (1) The extraction mass arrived at the maximum value when KOH concentration is about 17.5%. The micro/nano particles in Chinese-fir shavings would be discharged sufficiently in the KOH solution with the increasing of extracting time. (2) The diameter the micro/nano particles of wood extractives and hemicellulose is comparatively scattered according to volume fraction. Micro/nano particles in the diameter of 91.3-342 nm, 342-1720 nm is the most at the extracting time of 3 h, 16 h, 24 h, respectively (3) The diameter the micro/nano particles of wood extractives and hemicellulose is chiefly between 342 nm and 6440 nm according to number fraction. Micro/nano particles in the diameter of 91.3-342 nm, 91.3-342 nm is the most at the extracting time of 3 h, 16 h, 24 h, respectively. [C584]



### "Magnetic Cellular Automata (MCA) arrays under spatially varying field"

Magnetic Cellular Automata (MCA) is a variant of Quantum-dot-cellular automata (QCA) where neighboring single-domain nano-magnets (also termed as magnetic cell) process and propagate information (logic 1 or logic 0) through mutual interaction. The attractive nature of this framework is that not only room temperature operations are feasible but also interaction between neighbors is central to information processing as opposed to creating interference. In this work, we explore spatially moving Landauer clocking scheme for MCA arrays (length of eight, sixteen and thirty-two cells) and show the role and effectiveness of the clock in propagating logic signal from input to output without magnetic frustration. Simulation performed in OOMMF. [C585]

### "Advances in selective etching for nano scale salicide fabrication"

High temperature SPM based wet selective processing for multi-step NiPt silicide process on nanoscale CMOS structure with dual gate dense layout has been studied. The high temperature SPM process is found to have better etching selectivity between NiPt/TiN and nickel rich silicide ( $\text{Ni}_2\text{Si}/\text{Ni}_3\text{Si}_2$ ) and results in better sheet resistance ( $R_s$ ) and uniformity compare to HCL based process. The high temperature SPM process window is effective for Pt and induces very low material loss. Thus, it is a better selective etching process for multi-step silicide process that can scale with the CMOS technology toward 22 nm node. [C586]

### "A nano satellite constellation for detection of objects in earth orbit"

On February 10, the Iridium 33 and Cosmos 2251 communications satellites collided over northern Siberia. Earlier in 2007 the Chinese ASAT test was carried out against the Chinese FENGYUN 1C polar-orbiting weather satellite on 2007 January 11. Clouds with a large number of additional space debris have been generated by these two incidents. This tendency has been recognized by Europe in recent years and concerns were raised regarding Europe's own capability to monitor these assets appropriately. To give a recent example, EUMETSAT was informed by U.S. Air Force authorities that Europe's METOP meteorological satellite in low Earth orbit might be in the path of a piece of orbital debris. As a reaction to this situation, ESA has launched its own space situational awareness program recently at the ministerial meeting in November 2008. To support the European space situational awareness program a nano satellite constellation consisting of two satellites has been studied in the frame of a team design project. The very first study results shows that such a system can be a valuable contribution to the SSA program using an optical sensor system in orbit at a very low cost compared to larger satellites. The main advantage of such a system is independence from weather conditions and a large field of view, which promises a larger number of detections in shorter time compared to large aperture sized telescopes. [C587]

### "Electroluminescent organic light emitting micro/nanofibers fabricated using three-fluid coaxial electrospinning"

This paper presents the development of three-fluid coaxial electrospinning technology and its application in electroluminescent organic light emitting micro/nanofibers (OLEFs). It is demonstrated that one-dimensional micro/nano-scale light sources can be realized using a single-step, substrate-free fabrication process-three-fluid coaxial electrospinning. The OLEF devices are formed in air rather than on a substrate before coming to the object surface of interest, and do not require any thin-film deposition and high-resolution lithography processes that are generally used in current light emitting device technologies. Such micro/nano-scale OLEFs could be beneficial in applications ranging from bio-imaging to chemical and biological sensing to other nano-scale luminescence in general. [C588]

### "Magnetic Cellular Automata wires"

Magnetic Cellular Automata (MCA) is a novel take on an alternative technological actualization of Boolean logic machines. Not only has it been able to prototypically demonstrate successful operation of logical gates at room temperature; all key components necessary to implement any Boolean function has been realized. We present work further reducing the size of the single domain nano-magnet, approximately 100 times 50 times 30 nm, and physically implement two types of MCA wire architectures ferromagnetic and anti-ferromagnetic. We report the first physical implementation of shape engineered ferromagnetic wires and compare both wires under saturating magnetic fields in the Z direction. We have concluded experimentally, that for conventional data propagation between logical networks, ferromagnetic wires provide extremely stable operation. The high order of coupling we found under saturating magnetic fields demonstrates the flexible clocking nature of ferromagnetic wires and inches the technology closer to implementing complex circuitry. [C589]

### "Development of plasma integrated AFM nano manufacturing workcell"



As a very important material processing technology, plasma processing is able to modify sample surface through etching, deposition, activation, functionalization, polymerization, etc. However, the general plasma processing reacts on a large area of sample surface. Hence a mask is needed for selectively treating the sample surface. In this paper, a plasma integrated atomic force microscopic (AFM) nano manufacturing workcell has been developed, which consists of a micro plasma source and an integrated AFM nanomanipulation system. The miniature microwave plasma discharge applicator is able to create a miniature plasma stream with a diameter ranges from 2 millimeters down to micrometers. Hence the micro plasma will be able to locally treat a sample surface and has the potential to eliminate the requirement of masks. With the integrated AFM system, the sample surface is able to be inspected and further modified at nanoscale in the same chamber after machined by the micro plasma. The system design and implementation are presented in the paper. Experiments have been carried out to demonstrate the effectiveness of the system by locally etching a silicon substrate surface using the micro plasma source. [C590]

#### "Employing work function engineering and asymmetric gate oxide in nano-scale source-heterojunction-MOS-transistor"

The source-heterojunction-MOS-transistor provides high drain current. This is originated from the high velocity electron injection at the source edge due to band offset energy. However, these devices suffer from large off-state current. In this paper, we have analyzed the off-state current in this device and have proposed use of work function engineering as well as asymmetric gate oxide to minimize the magnitude of this off-state current. The analysis of the off-state current characteristics shows that provided 93% reduction in off-state current. [C591]

#### "Design and fabrication of si-based photonic crystal stamps"

In this work we report on the technology for enabling the mass replication of custom-designed and e-beam lithographically prepared structures via establishing UV-NIL nanoimprint processes for pattern transfer into UV curable pre-polymers. The new nano-fabrication technology based on the concept of disposal master technology (DMT) is suitable for mass volume manufacturing of large area arrays of sub-wavelength photonic elements. To show the potential of the application of the new nanoimprint technologies we choose as an example the fabrication of a photonic crystal (PhC) structure with integrated light coupling devices for low loss interconnection between PhC light wave circuits and optical fiber systems. We present two kinds of PhCs for fabrication of nanoimprint lithography stamps in Si. (a) A photonic crystal of Si-rods in air. This structure was fabricated with electron beam lithography (EBL) in resist and after lift-off, there is a mask of Cr on Si, then the pattern transfer into Si is performed using reacting ion etching (RIE) with SF<sub>6</sub> as etch gas. We use 260 nm of positive resist (950 K PMMA) for EBL exposure. Resist thickness, exposure dose, development time and parameters for etching have been optimized in this method. (b) In the second method lift-off was performed and metal mask was used as master. The subsequent steps for fabricating the master will be presented detail in our contribution. [C592]

#### "Ozonation Catalyzed by TiO<sub>2</sub>/Zeolite for Degradation of Nitrobenzene in Aqueous Solution"

This paper investigated the catalytic ozonation of aqueous nitrobenzene (NB) in the presence of nano-TiO<sub>2</sub>/zeolite. The removal efficiency of NB was increased from ozone alone at 12.57% to in the present of catalyst at 33.76%, significantly. The optimum calcination temperature of nano-TiO<sub>2</sub>/zeolite was found out at 600degC. Catalytic ozonation of nitrobenzene was first order reaction with respect to the initial concentration of nitrobenzene. With the dose of radical scavengers increased, the degradation of NB decreased significantly, which proved that OH<sup>-</sup> was the dominating species in the oxidation process. Removal rate of NB increased with the increase of temperature from 10degC to 40degC. NB degradation varied with pH value, and reached the best removal rate at approximately pH 10. Catalyst showed good stability after 3 times repeated uses. [C593]

#### "Wireless Sensor Network: Intricate modeling and analysis of CNT and MEMS based sensor nodes"

We have analyzed the effect of innovations in Nanotechnology on Wireless Sensor Networks (WSN) and have modeled Carbon Nanotube (CNT) and Micro-Electro-Mechanical Systems (MEMS) based sensor nodes. SUGAR library in MATLAB has been used to illustrate the static analysis of deflection, display the structure and to compute the displacement parameters of a cantilever beam subjected to an external force. A WSN (Wireless Sensor Network) model has been programmed using Simulink in MATLAB. We have shown the integration of CNT in WSN as CNT based sensors, microprocessors, batteries etc. A proposition is put forward by us on the changes needed in the existing sensor node structure to improve its efficiency and to facilitate and enhance the assimilation of CNT based devices in a WSN. We have shown the functioning of CNT based Nano devices in WSN technology. Finally we have commented on the challenges that exist in this technology and described the



important factors that need to be kept under consideration for the calculation of the reliability of CNT based devices and their key effects on the WSN environment. [C594]

### "Effect of Nano SiO<sub>2</sub> on Pyrolytic Reaction of Phenol-Formaldehyde Resin"

Phenol-formaldehyde resin is used as the most adhesive to produce waterproof plant-based composite. However, this product contains phenol and formaldehyde which can be easily released to pollute air. Based on the single-factor method, the effect of nano SiO<sub>2</sub> on situation of pyrolytic reaction of PF resin was studied by Py-GC/MS. The results were shown that the components of PF by Py-GC-MS analysis were carbon dioxide(83.54%), D, .alpha.-tocopherol (12.55%), 1,3-bis(trimethylsilyl) benzene (1.96%), phenol(1.95%). And the results were shown that the main components of PF/SiO<sub>2</sub> composite by Py-GC-MS analysis were as follow: carbon dioxide (60.37%), 2-butanamine (14.41%), fluoxetine (12.09%), 2,6,10-dodecatrien-1-ol, 3,7,11-trimethyl-, acetate, (E,E)- (3.38%), bis(2-ethylhexyl) phthalate(3.35%), phenol, 2-methyl-(3.12%), phenol(2.39%), 2-propanamine(0.89%). The result showed that nano SiO<sub>2</sub> could effectively delay the pyrolysis of PF resin. [C595]

### "Surface plasmon polaritons in nano-waveguides with semiconductor guiding layer"

Surface plasmon propagation in nano scaled waveguide containing a semiconductor film embedded in dielectric media is studied in this paper. The analytical dispersion relation is reached for the symmetric and antisymmetric mode. The propagation characteristics is analyzed for various material and structural parameters. As an application to integrated waveguide elements, a garnet layer bonded on semiconductor-on-insulator waveguide structure, is considered. The nonreciprocal phase shift as a function of the propagating semiconductor layer thickness at different wavelengths is also studied. [C596]

### "The research of electronic service applied to medical industry"

This study targeted at personalized medical cares under electronic environment of information technology and the treatment of smart nano-drug carriers in biomedical engineering clinical applications of the future. Nowadays, the trend of large-scale striking to hospitals, the requirements of patients asking for better medical services. Based on multiple requests, hospitals will need e-working environment and medical information management to assist the hospital operation. The major problem in health care field is that staff cannot immediately obtain the necessary information, such as electronic medical records and physical condition. The use of information network technology can improve the problem. In order to design effective drugs, biomedical nanotechnology owns a potential prospect of industrialization when it comes to the drugs and the delivery of them in nanometer level. The advantages of RFID into hospital are effective to manage many processes. The combination of automation and IT provides automatic monitoring of physiological capacity. Based on virtual enterprise private network (VPN) platform, VPN provides the wireless environment for long-distance nursing to keep track of patients' physiological data which would be routinely measured. This data can be sent back to Disease Surveillance Information System of VPN Union Center for real-time analysis to help forecast. The advantages of magnetically targeted drug delivery in the clinical use of drugs are controlling lesion gathered in order to enhance medical efficiency and reducing the drug side effects in organisms. Next, treat to high-frequency electromagnetic radiation, the magnetic particles in vivo absorbed electromagnetic energy and the temperature of the local area rose. All in all, The way to enhance competitive advantage in medical and health industries is only to import electronic. Biomedical Nanotechnology MEMS technology used in the field of health care, the development of nano-materials for drug-treatment and the application of considerable research is potential definitely. [C597]

### "Small-sized large travel nano-positioning system based on tubular permanent magnet synchronous linear motor"

With the high-speed development of modern science and technology as well as the rapid advancement of manufacturing technology, especially the micro-machining technology and semiconductor manufacturing, the feature size of micro-structure machinery is getting smaller and smaller and the positioning accuracy requirements for micro-machining platform and measurement platform have been increased to nanometer class. At present, small-sized and large travel nano-positioning system has become the research focus of the major countries in the world. In this paper, a miniaturized nano-positioning system based on the tubular permanent magnet synchronous linear motor and grating is established, in which the linear motor is adopted to realize large travel actuation and nano-positioning control and the grating is utilized as displacement measuring and feedback controlling device. Through the study of actuation control strategy and feedback control method, the actuation speed of greater than 3 mm/s and positioning stability of less than 10 nm in the 100 mm actuation range are obtained. [C598]

### "Measurements on mechanical properties of boron-doped silicon materials for micro inertia sensor"



The capacitive structure of comb capacitive micromachined gyroscope is a kind of important structure. The mechanical properties of micro inertia sensor material had changed when the structures experienced high temperature boron diffusion, lithography and etching et.al. micromachined process. Therefore, it is necessary to measure the basic mechanical properties of boron-doped material in order to supply exact material parameters for design and fabrication of micro inertia sensor. With the rapid development of measurement technologies, the nano indentation technology had become an ideal method to obtain the mechanical properties of MEMS structures material accurately. We obtained the elastic modulus and hardness of heavy boron-doped silicon material using nano indenter. The experimental results showed that the elastic modulus and hardness of heavy boron-doped silicon material had increased comparing with the silicon material. [C599]

#### **"Nanobond® assembly-a rapid, room temperature soldering process"**

Reactive nanotechnologies (RNT) has commercialized a new technology that will revolutionize how manufacturers join components using solder materials. (See Figure 1) The joining process is based on the use of reactive multilayer foils as local heat sources. The foils are a new class of nano-engineered materials, in which self-propagating exothermic reactions can be ignited at room temperature through an ignition process. By inserting a multilayer foil between two solder layers and two components, heat generated by the reaction in the foil melts the solder and consequently bonds the components. The joining process can be completed at room temperature in air, argon or vacuum in approximately one second. The resulting metallic joints exhibit thermal conductivities two orders of magnitude higher, and thermal resistivities an order of magnitude lower, than current commercial TIMs. The use of reactive foils as a local heat source eliminates the need for torches, furnaces, or lasers, speeds the soldering processes, and dramatically reduces the total heat that is needed. Thus, temperature-sensitive or small components can be joined without thermal damage or excessive heating. In addition, mismatches in thermal contraction on cooling can be avoided because components see very small increases in temperature. This is particularly beneficial for joining metals to ceramics. The fabrication and characterization of the reactive foils is described, and the value proposition for nanobonding is presented. This paper also shows the applicability of this platform technology to many areas of packaging including thermal interface materials, microelectronics, optoelectronics, and light emitting diodes (LEDs). [C600]

#### **"Technology of single-material field-emission diode using polycrystalline diamond"**

This paper presents the technology of single-material field-emission diode using polycrystalline diamond. I-V characteristics are studied at different poly-C doping levels, methane concentrations and temperatures. Field emission characterization system and testing of SMFD diodes are also reported in this presentation. [C601]

#### **"Advancements in bumping technologies for flip chip and WLCSP packaging"**

At R&D level, IZM has advanced stencil printing very close to its technological limits at pitches even down to 50  $\mu\text{m}$ . Innovative electroformed and laser-cut with nano-treatment stencils have been manufactured with an extreme thinness of 20  $\mu\text{m}$  for bumping wafers at ultra fine pitches (UFP) of 100  $\mu\text{m}$ , 80  $\mu\text{m}$  and 60  $\mu\text{m}$ . Specifically, for 100  $\mu\text{m}$  pitch bumping, both type 7 (2-11  $\mu\text{m}$ ) and type 6 (5-15  $\mu\text{m}$ ) pastes of eutectic composition Sn63/Pb37 have been successfully employed. Bumping using 25  $\mu\text{m}$  electroformed stencil thickness has yielded bump heights of 42.3  $\mu\text{m}$  and 43.6  $\mu\text{m}$  for type 7 and type 6 pastes, respectively. A newly prototype developed type 8 paste (2-8  $\mu\text{m}$ ) has been used for the first time to bump chips with peripheral contacts at 80  $\mu\text{m}$  and 60  $\mu\text{m}$  pitch. Bumping at 80  $\mu\text{m}$  pitch with nano-treated laser-cut stencil has yielded bumps of 28  $\mu\text{m}$  in height. For bumping at 60  $\mu\text{m}$  pitch, a 20  $\mu\text{m}$  thick electroformed stencil was used with 35  $\mu\text{m}$  times 80  $\mu\text{m}$  oblong apertures. Printing at 60  $\mu\text{m}$  pitch has yielded very promising results and has proved the capability of electroformed technology to manufacture accurate and robust thin stencils. The bump height at 60  $\mu\text{m}$  pitch was measured to be 28  $\mu\text{m}$ . Paste-in-resist technology has been developed as an alternative to stencils in order to overcome the manufacturing difficulties of making extremely small apertures. Paste is printed in resist apertures which have been opened by photolithographic processes. In this way, bumping has been demonstrated up to 50  $\mu\text{m}$  pitches. Complimentary to stencil printing processes, IZM has developed balling technologies up to 400  $\mu\text{m}$  pitch up to 8rdquo wafers with a thickness of 150  $\mu\text{m}$ . Solder balling can be achieved either by Idquo perform ball printrdquo using conventional stencil printers with specially designed stencils or by Idquoball droprdquo techniques. Balling technologies have demonstrated the application of 300  $\mu\text{m}$  and 250  $\mu\text{m}$  Sn-Pb and Pb-f- ree balls at respective area array pitches of 500  $\mu\text{m}$  and 400  $\mu\text{m}$ , the main I/O pitches for WL-CSP bumping. [C602]

#### **"Closing technology knowledge gaps: Projects arising from the iNEMI technology roadmap"**

iNEMI has been publishing its technology roadmap biannually for the last 14 years. The strength of these roadmaps has been the depth of the knowledge from experts worldwide combined with the breath of view taken



across the whole electronic manufacturing supply chain. Every new roadmap helps identify the technology gaps in various aspects of the supply chain. These gaps then stimulate and encourage dialogue to develop consensus-based strategies resulting in industry-based joint project work or promoting research areas to the academic communities. Since 2007, there has been a focus on three main technology areas for iNEMI industry-based projects: energy and the environment, miniaturization and medical electronics. This paper will cover the goals of these three areas and the strategies being adopted to address the present and future technology gaps, as identified in the most recent roadmaps. Results from key projects in the three areas will be presented. These will include projects on Pb-free alloy alternatives and HFR-free substrates; higher density testing and nanosolders, and medical components reliability. [C603]

#### **"Piecewise-polynomial modeling for analog circuit performance metrics"**

In nano-scale IC technologies, analog performance metrics are highly non-linear and cannot be accurately captured by traditional response surface models. In this paper, we propose a piecewise modeling algorithm that optimally partitions the parameter space into several regions and, on each of them, fits a linear or a quadratic function to the performance metrics. This piecewise modeling strategy efficiently combines good global and local approximation properties. [C604]

#### **"Variability-Tolerant Binary Content Addressable Memory Cells"**

Within-chip variability has become a serious problem in modern nano-scale technologies, which is particular true for semiconductor memory designs. This paper proposes four-types of variability-tolerant (VT) binary content addressable memory (BCAM) cells. The VT-BCAM cells are designed by separating the read port from the write port such that the sizing for read static noise margin (SNM) and write trip voltage (WTV) is decoupled. By reusing the comparison logic of a BCAM cell as the read port, moreover, only an additional transistor and a read wordline are needed. Experimental results show that in comparison with the typical BCAM cell the proposed variability-tolerant BCAM cells can provide about 0.655V increment of read SNM by paying about 13% additional cell area. [C605]

#### **"Design of a low-vibration micro-stepping controller for dom-camera"**

Fast, smooth and accurate motion is the important properties of dom-camera (DC). In the case of a high ratio zoom lens, low vibration characteristic is an also crucial point in driving pan-tilt mechanism in DC. In this paper, a novel microstepping controller with a function of adjusting reference current was designed using field programmable gate arrays (FPGA) technology for high zoom ratio dom-camera. The proposed variable reference current (VRC) control scheme reduces vibration and increases maximum acceleration without missing steps. By employing VRC control scheme, the vibration in low speed could be significantly minimized. The proposed controller can also make very high speed of 378 k pps micro-step driving, and increase maximum acceleration in motion profiles. [C606]

#### **"Principles of nano-robotics based on atomic force microscopy"**

Nano-technology, which aims at the ideal miniaturization of devices and machines down to atomic and molecular sizes, has been a new topic as a promising high technology for the forthcoming century. By precise control of atoms, molecules or nano-scale objects, new sensors and manmade materials, tera-byte capacity memories, micro-scale robots and machines, quantum devices, micro-scale distributed intelligence system devices with integrated sensors, actuators and communication tools, etc., would be possible within the near future. Atomic Force Microscope (AFM) is primarily a tool for characterizing surface topography, but there is also a strong interest in using AFM as a nano-manipulator to modify the sample surface or manipulate nano-structures such as nanoparticles. Nano-manipulation using the atomic force microscope has been extensively investigated for many years. It is greatly important to understand the mechanics of AFM-based nanorobotic manipulation for efficient and reliable handling of nanoparticles. The purpose of this paper is to introduce some facilities, nano-manipulation system, some kind of micro-cantilevers, principle of nano-modes, nano-contact mechanic theories and nano-forces in atomic force microscopy. [C607]

#### **"Transmission characteristics study of memristors based Op-Amp circuits"**

According to a physical memristor fabricated by nano technology, a monotone-increasing and piecewise-linear nonlinear memristor model is applied to study the transmission characteristics of memristors based inverting and noninverting op-amp circuits. Simulation results demonstrated that inverting amplification and noninverting amplification can be obtained in the memristor based op-amp circuits. [C608]



### "Fabrication of bottom die substrate solderless interconnection based on nano copper wires"

Direct copper bonded (DBC) bottom die substrate attachment is usually ensured by solder joints but with regard to reliability it remains the weakest component of the package. The sustained trend for high power density requires new interconnection technologies. Nanowires seem to be a promising candidate for interconnection applications in power electronics and microelectronics. This paper presents the fabrication process of an innovative solderless interconnection based on copper nano-wires by electroplating process, itself using the anodic aluminum oxide (AAO) template. Some mechanical and electrical characterizations are investigated in order to evaluate this interconnection technology. [C609]

### "Pulsed vacuum flashover properties of micro and nano Al<sub>2</sub>O<sub>3</sub>·3H<sub>2</sub>O/epoxy composites"

Micro and nano Al<sub>2</sub>O<sub>3</sub>·3H<sub>2</sub>O fillers are loaded into the epoxy resin by mixing different weight ratio. The flashover studies were conducted using three kinds of nanosecond rise pulse under 5 times 10<sup>-3</sup>Pa vacuum. The surface flashover properties of nano and micro Al<sub>2</sub>O<sub>3</sub>·3H<sub>2</sub>O/epoxy composites are presented. The influence of filler size and content on the interface structure, interface layer distribution and interface volume proportion was discussed. The relationship between particle size influence and flashover voltage was analyzed. A deep and shallow trap model based on the multi-layer model was proposed. Considering the size influence of fillers, the flashover characteristic was able to be explained. [C610]

### "Effect of compound technology on polyethylene/ montmorillonite composites"

The dielectric properties of nanometric dielectrics have attracted much attention since John Lewis published the article; the title is "Nanometric Dielectrics", on IEEE transactions on dielectric and electrical insulation in 1994. However, the majority of works reported in the literature were involved in comparing the dielectric properties of polymer/inorganic nano-particles composites those of with polymer/inorganic micro-particles composites, and investigation on dielectric properties of polymer layered silicate (PLS) nano-composites, which exhibit excellent thermal and mechanical properties, were rarely found to be reported. The paper investigates the effect of dielectric property of nano-montmorillonite transnature polyethylene (PE), the polyethylene/montmorillonite (PE/MMT) nano-composites are prepared by melting intercalation process. The dielectric properties of the nano-composites are investigated, and then the space charge profile in PE/MMT and PE is measured by pulsed electro-acoustic (PEA) method respectively. The test results indicate that the involvement of nano-MMT can decrease the amount of space charge in dielectric The AC breakdown strength can be enhanced. [C611]

### "Study of the synthesis of WO<sub>3</sub> nano-structured arrays by tungsten hot filament chemical vapor deposition method and their field emission properties"

Here in this work, the hot filament chemical vapor deposition method is adopted, with an extra heating stage is employed as well, to control the substrate temperature precisely. Since this method, different kinds of WO<sub>3</sub> nano-structure arrays were prepared, and their FE properties were studied. [C612]

### "Effects of service parameters on thermomechanical fatigue behaviors of new nano composite solder joints"

Thermomechanical fatigue (TMF) resulted from the mismatch in the coefficient of thermal expansion (CTE) between solder and substrate would degrade the mechanical properties of solder joints during service. In this research, nano-structured polyhedral oligomeric silsesquioxane (POSS) reinforcing particles were incorporated into a promising lead-free solder, eutectic Sn-3.5Ag solder, by mechanically mixing to improve service reliability of the base solder matrix. Three different temperature profiles, with the same temperature extremes of -40degC to 125degC, different dwell times at temperature extremes and ramp rates, were applied in the tests. Microstructural characterization of surface damage and residual shear strength of these solder joints were carried out after 0, 100, 250, 500 and 1000 TMF cycles. Results obtained from this study were used to analyze the effect of service parameters on the TMF behaviors of the nano composite solder joints. Experimental results indicated that the nano composite solder joints exhibited better TMF performance than the eutectic Sn-Ag solder joint. It also proved that the nano composite solder joints that experienced longer dwell time and slower ramp rate exhibited less surface damage accumulation and less decrease in shear strength of solder joints. [C613]

### "Super-hydrophobic nickel films with micro-nano hierarchical structure prepared by electrodeposition for appliance industry"

Super-hydrophobic Nickel films were prepared by a simple and low cost electrodeposition method. The surface morphology of the films characterized by FE-SEM exhibit hierarchical structure with micro-nano cones array,



which can be responsible for their super-hydrophobic characteristic (water contact angle is over 120 degree) without any chemical modification. The wettability of the film can be varied from super-hydrophobic (water contact angle 143 degree) to relatively hydrophilic (water contact angle 87 degree) by controlling the size of the micro-nano cones. The mechanism of the hydrophobic characteristic of nickel films with this unique structure was illustrated by several models. Such novel micro-nanostructure and its special wettability are expected to be applied in miniature aquatic devices, micro-fluid devices, satellite antenna, and conductors with self-cleaning surfaces etc. [C614]

#### **"The fabrication of composite solder by addition of copper nano powder into Sn-3.5Ag solder"**

Copper nano powder was incorporated into Sn-3.5Ag solder at 3wt%, by mechanically alloyed (MA) by ball milling in a planetary ball mill at room temperature. The rotation speed was kept constant at 150 rpm with different milling time, 26 hours, 78 hours and 120 hours. The milled solder was mixed with flux and reflowed at 240degC for 60 seconds. XRD result confirmed the formation of Cu<sub>3</sub>Sn after 120 hours of milling time. The melting temperature of the samples decreased as a function of milling time. The wetting angle was improved by 48% for the composite solder Sn-3.5Ag-nano-3.0Cu for 120 hours ball milled, compared to the Sn3.5Ag solder. Increased of hardness was obtained as a result of incorporation of nanoparticle. [C615]

#### **"Electrically conductive adhesives with sintered silver nanowires"**

Concerning the hazard to human and environment by lead, the lead-free solders and the electrically conductive adhesives (ECAs) have been considered as the most promising alternatives of the tin-lead solder. Electrically conductive adhesives offer numerous advantages compared to conventional solder technology such as environmental friendliness, mild processing conditions, low stress on the substrates, and fine pitch interconnect capability. It has received considerable attention in microelectronic packaging that the nano-size metal particles fuse at much lower temperature than the melting point of the bulk metal. The sintering of nano-size silver in ECAs can reduce the number of contact points between fillers and increase the conductivity of ECAs. The silver nanowires with a slenderness ratio of 50~60 were successfully synthesized through a polyol process and characterized by field emission scanning electron microscopy (SEM) in this paper. The silver nanowires began to sinter at 200degC and conductive adhesives filled with silver nanowires were studied. [C616]

#### **"Synthesis and characterization of Nano BaTiO<sub>3</sub> /epoxy composites for embedded capacitors"**

The miniaturization trend of integrated circuits (ICs) calls for replacing discrete passive components with embedded passives. Among the passive components, the embedded decoupling capacitors which are used for simultaneous switching noise suppression have drawn great attention. It is because decoupling capacitors should be placed as near as possible to a chip to reduce parasitic inductance. Important requirements for embedded capacitor materials are high dielectric constant, low capacitor tolerance, good processibility and low cost. BaTiO<sub>3</sub>-filled epoxy composite is a promising material to meet the above requirements. It utilizes the high dielectric constant of ceramic powders and processibility of polymers. The dielectric behavior of the composite is influenced by the crystal phase type, grain size and dispersability of the BaTiO<sub>3</sub> particles distributing in it. In this study, nano-sized BaTiO<sub>3</sub> powders have been synthesized with a modified hydrothermal reaction method. The powders possess tetragonal crystal phase with a narrow size range around 50 nm. The dielectric constant of the epoxy filled with BaTiO<sub>3</sub> is 19.4 at the frequency of 10 kHz when the loading of BaTiO<sub>3</sub> was 50 vol% and the dielectric loss factor  $\tan\delta$  is about 0.02. It is believed that the high dielectric constant and low loss are attributed to the pure tetragonal phase and good dispersing of the nano particles. [C617]

#### **"Windmills & CSFs for ERP-diffusion of technovation in academia-industry: A qualitative analysis"**

The enterprise resource planning (ERP) is one of the strategic-consideration in any multifaceted manufacturing industry. In past one decade, globally the requirement of ERP for academia and industry has experienced exceptional augmentation. Globally aviation industry has adopted ERP-software packages in pursuit of competitive advantage over rival industries. The innovation in material and manufacturing management systems has altered the dynamics of shop-floor-scene. The induction of advanced manufacturing technologies, Nano-technology, Composite-materials and psychometric testing of highly skilled labor in a target focused team environment has enormously enhanced the prospect from 5Ms [these 5M-resources are namely man, machine, material, money and minute (time)]. The resource-management and supply-chain-management is becoming extremely complex and require dedicated ERP modules for better management and effective control over the industrial and financial activities through integrated business intelligence (BI) software. While most of the companies have shifted from conventional manufacturing operations to MRP supported operations, yet the rate of success for adaptation of ERP is far less than expectations. Hence, it has become more critical to observe the methodology for diffusion of ERP technology in a complex manufacturing industry. Conversely, in the absence of



sufficient knowledge-areas the critical variables responsible for diffusion of ERP has emerged as inevitability for implementation of ERP in an industry. In contemporary competitive global-village the ERP-implementation is a cumbersome process and takes years before it yields and reveals its effectiveness. A number of working principles and guidelines have already been developed in other industries and can be employed in a variety of ways in aerospace manufacturing industry for optimum performance and to earn competitiveness through ERP suites. This paper provides critical success factors (CSFs) for diffusion of ERP knowledge areas i.e., technovation (technological-innovation) equally applicable to a multifaceted-industry or a university-aerospace-department involved in R&D programs in a joint venture with industry. [C618]

#### "Electroless plating of copper nano-coned array for high reliability packaging"

Nano-coned array of Cu were prepared by electroless plating with special crystallization conditioning agent. The morphologies of nano-coned array were observed by FE-SEM. The influences of active time in PdCl<sub>2</sub>, concentration of NiSO<sub>4</sub>·6H<sub>2</sub>O, crystallization conditioning agent, pH and temperature of plating solution were discussed. Then, the possible reasons of the influence on the growth of nano-coned array were investigated. NiSO<sub>4</sub>·6H<sub>2</sub>O was proved as catalytic active agent. The optimum preparation conditions were fixed. The crystal crystallographic orientation and elements of the nano-coned array were measured using TEM and EDX. The nano-cones consist of 95.57% copper and 4.43% nickel. The crystal crystallographic orientation of them is typical copper FCC single crystal. [C619]

#### "A Modified FTA-FMEA Methodology: An Application for CNT-BLU of TFT-LCD"

Both new technology and new product improve the customers satisfaction. Carbon Nano-tube Back Light Unit (CNT-BLU) is a new product which uses CNT in the design of the back light unit for TFT-LCD. However, there are many problems with this new technology. The processes of determining the causes of the manufacturing process problems usually take considerable time when the problems occur. The objective of this study is to propose a modified FMEA which integrates FTA, Cause and Effect Diagram, FDM. We presented step-by-step procedures to perform process analysis for CNT paste printing problem in the production of CNT-BLU. After conducting a real-word case analysis, we found that results coincide with the consensus of experienced experts. It shows that the proposed methodology is a useful tool for failure analysis in the analysis of CNT-BLU manufacturing process problems. Furthermore, this method can also be applied to the related fields of failure analysis. [C620]

#### "In-situ TEM observation and electrical measurement of gold nanocontact during tensile test using MEMS opposing tips"

Gold nanocontact was formed between gold opposing tips in the ultra high vacuum transmission electron microscope (TEM). Quantum changes in conductance were observed at room temperature during the thinning process of the nanocontact. In the nanotechnology research, it is essential to study the relationship between the shape and the characteristic at a nano scale. The characteristics of nano structures can be easily affected by the atomic sized shape change because even such minute shape changes are not negligible as compared to nano structures. In order to investigate the effect, one of the promising approaches is the real time observation of nanoscopic change in a nano structure, while its characteristics are measured. However, it is extraordinary difficult to observe nano scaled structural change in real time. We have developed MEMS (microelectromechanical systems)-in-TEM system to tackle this difficult issue. As for the nano scaled structural change, MEMS technology can provide tips as sharp as tens of nanometers; by pushing them together a nano contact is formed. MEMS actuators that are very stable and precise are able to pull and deform the contact very slowly. In addition, TEM is a powerful tool for a real time observation at a nano scale. Therefore, we introduced MEMS opposing tips into TEM in order to visualize the structural deformation at a contact point between tips. [C621]

#### "Nano-sized hexagonal platelet-like ZnO for the nano-phosphor application"

In this presentation, a facile method has been developed to produce large quantities of ZnO nanocrystals with hexagonal shape. In the presence of sodium bis (2-ethylexyl) sulfosuccinate (AOT) emulsions as a structure-direct agent, the reaction of hexamethylenetetramine (HMT) in Zn<sup>2+</sup>-aqueous solution forms ZnO phosphors. Second, both micro-sized and nano-sized platelet-like ZnO nanocrystals have been produced by the control of the reaction conditions. Third, the luminescent properties of as-prepared and annealed powders have been characterized by both cathodoluminescence and photoluminescence. Finally, the micro-sized ZnO platelet has been characterized by a pulsed YAG laser. With the increase of the laser intensity, the emission shows nonlinear phenomena, which indicates that the lasing action occurs in the sample. [C622]



### "Enhanced field emission properties from two-step screen-printed carbon nano-tube film"

Carbon nanotubes (CNTs) have been widely studied as a electron emitting sources of thin cold cathode. Screen printed technology has advantage of large size display, easy process and low cost, hence it attracts much more attention than other traditional method in the fabrication of CNT-FED. However, due to random distribution of CNTs in printed cathode film, poor luminance and emission uniformity have hindered the further commercial development of CNT-FED. Two-step screen-printed carbon nanotube film is presented here. CNT paste was synthesized by mixing of CNT powders, organic binders and inorganic vehicles. The prepared pastes were screen-printed on ITO glass with the printing area of 2.5 cm<sup>2</sup>, and conducted a heat treatment. Re-printed and third-printed process was conducted upon the as-printed one. Microstructure of the films was characterized via field emission scanning electronic microscopy (FESEM JEOL JSM6700F) and the OLYMPUS laser scanning confocal microscope (LEXT OLS3100). Additionally, the field emission characteristics were tested in diode structure. The vacuum level is about 5<sup>times</sup>10<sup>-6</sup>Torr. [C623]

### "CNT logic knowledge module integrated in digital CMOS logic design course"

We present a knowledge module exposing students to novel Nanodevices and computing issues in the context of CMOS Design. This knowledge module has a two-fold objective. First, it generates interest amongst students regarding the fundamental concept of future nano-devices. This will motivate them to enroll in other elective courses related to Nanotechnology, being offered in most EE and CS departments. Further, this module can be used to let students analyze, synthesize and apply their existing knowledge of digital logic design into revolutionary design context with CNT logic. Assessment included the development of rubrics for grading students understanding of key concepts. Survey results and comments indicate that 89% of the students liked the module and demonstration, as well as were enthusiastic and motivated to learn more on nano devices. [C624]

### "Nano resonator simulation fabrication and packaging consideration"

A study on simulation, fabrication and packaging of metallic nano resonator is presented. The nano resonator is modeled with an equivalent circuit and simulated using HSPICE. CMOS compatible process is used to fabricate the nano resonator with a minimum modification. The suspended part of the device is released using HF vapor-phase etching. Packaging of nanoscale device is conceived based on the features, fabrication process and the application of the nano resonator. [C625]

### "Advanced package design for electronic and MEMS applications supported by fe analyses and deformation measurements"

Sensor packages have often to be adapted to current customer requirements. Dimensions, interior structures, or materials may change. In general, this influences strongly the thermally induced warpage during the wafer level manufacturing process and of the separated single packages which has to be controlled with respect to reliability issues. Therefore, the package manufacturer needs for a proved methodology: Numerical studies by means of finite element (FE) analyses combined with experimental warpage determination are proposed which enable reliability assessments before real parts are available. Parametric studies by means of FEM are applied to the manufacturing process and its variations, taking into account carefully determined temperature-dependent material data, including cure shrinkage and visco-elastic behaviour of mold compounds. Several modelling strategies (batch module, one single module only, and an intermediate approach) are compared with respect to the computed bending for a typical set of parameters and with the real warpage of a thermally loaded test structure, measured by means of Thermo-Moire. [C626]

### "Effects of inorganic components on aggregate structure of the PI/SiO<sub>2</sub> hybrid film"

In this paper, polyimide/SiO<sub>2</sub>(PI/SiO<sub>2</sub>) hybrid films were prepared via the Sol-Gel process and thermal imidization by the hydrolysis and condensation of triethoxysilane (TEOS), methyl-triethoxysilane (MTEOS) and dimethyldiethoxysilane (DDS) served as inorganic precursor respectively. The coupling agent used in these hybrid films is 3-aminopropyltriethoxysilane (APrTEOS). The microstructure of hybrid films was characterized by scanning electron microscope (SEM) and atomic force Microscope (AFM) respectively. The result shows that in the PI/TEOS-SiO<sub>2</sub>hybrid film, the inorganic particles in nano size were isolated when the silica content was 5 wt%. While for the PI/MTEOS-SiO<sub>2</sub>hybrid system, there were a few holes in the organic matrix and the silica particles is in the shape of oval-like and the particles produced agglomerating with the increasing of inorganic component. The quantity of holes was increased on the surface of the PI/DDS-SiO<sub>2</sub>hybrid system films. The inorganic particles were in the shape of sphere and generated agglomeration. So DDS is often used with other inorganic precursor. [C627]



### "FPGA based on integration of carbon nanorelays and CMOS devices"

In this paper, a novel reconfigurable architecture, cFPGA (CMOS-Nanorelay FPGA) is developed by integrating carbon nanorelays and CMOS devices to function as FPGA components. cFPGA is a highly efficient architecture, providing 2ГrB— density and standby power improvement along with 30% dynamic power reduction as compared to the CMOS FPGA circuits. This performance improvement is achieved by using 2T1N structures as routing switches: Two CMOS transistors (2T): one for programming purpose and the other for signal transmission; one nanorelay (1N): the switching element. These 2T1N structures do not have nanorelays in the signal path, thereby eliminating the large quantum resistance in the path. This is a significant improvement over the conventional CMOS-nanorelay hybrid FPGA circuits. The proposed cFPGA is implemented using vertical carbon nanotubes which are relatively easier to fabricate as compared with horizontal nanotubes. [C628]

### "Online detection of multiple faults in crossbar nano-architectures using dual rail implementations"

Crossbar nano-architectures based on self-assembled structures are promising alternatives for current CMOS technology, which is facing serious challenges for further down-scaling. However, high permanent and transient failure rates lead to multiple faults during lifetime operation of crossbar nano architectures. In this paper, we propose a concurrent multiple error detection scheme for multistage nano-crossbars based on dual-rail implementations of logic functions. We provide the proofs of detectability of all single faults as well as most classes of multiple faults. As shown by simulation results, unlike traditional methods such as TMR, the proposed scheme is capable of detecting more than 99.85% of multiple (transient and permanent) faults. [C629]

### "Optical antennas for vector near-field imaging"

A new method for nano-engineering the optical antenna properties of scanning probe tips by combining focused ion beam milling with nano-CVD is presented. We demonstrate the capabilities by probing specific vector-field components of plasmonic nanostructures. [C630]

### "System-level energy and performance projections for nanomagnet-based logic"

This paper examines how realistic implementations of the drive circuitry needed to control circuit elements made from nano-scale magnets can affect system-level energy and performance. Expected non-uniform clock fields, clock field discontinuities and out-of-plane fields are all considered. We find that realistic fabrication mechanisms should not inhibit logical correctness and that this technology appears capable of outperforming low power CMOS equivalents with similar energy requirements-and paths to additional energy savings exist. [C631]

### "Microwave plasma-assisted diamond synthesis reactor design for large deposition areas at high rates"

Summary form only given. The Microwave plasma assisted CVD synthesis of diamond was first demonstrated during the early 1980s by Kamo et al [1]. Diamond synthesis was achieved in a small ( 2-4 cm ), tubular reactor where microwave energy was coupled into a quartz tube that was inserted through a waveguide. This reactor produced high radical densities and high quality diamond films and was inexpensive, simple to design, construct and operate. Hence it was utilized by many early diamond researchers to experimentally investigate and understand CVD diamond synthesis. However this reactor type had a number of inherent limitations such as small deposition area and low operating pressure regime. Since these early investigations the significant potential of industrial applications of CVD diamond synthesis has spurred numerous, innovative, microwave plasma reactor designs. In view of the important, recent, opportunity to commercially synthesize a variety of high quality diamond materials, i.e. nano crystalline diamond, polycrystalline diamond and single crystal diamond, there is a need to further improve existing designs and to develop entirely new microwave plasma-assisted reactor designs that are able to achieve diamond synthesis at high rates and over large areas. For example, certain applications require large (12-20 cm diameter) deposition areas, while other applications require high rates (30-50 micron/hr) and often some reactor users desire large areas, high rates and very high quality. Since it is important to increase deposition rates it is desirable to develop and optimize new reactors and processes in the 100-300 Torr pressure regime. This presentation will look at microwave plasma reactor design in view of the need for operation in the 100-300 pressure regime. In particular the following will be discussed: (1) the "basic physics" behavior of the microwave discharges at high pressure, (2) microwave discharge stability, (3) the thermal management of the substrate e- nvironment, (4) reactor design using computational modeling, and (5) the trade off between large area deposition uniformity and high growth rates. Technologies that yield large area, uniform, high rate, high quality and controllable deposition will be described. [C632]

### "Micro/nano-particle electrostatic accelerator for electric propulsion"



Summary form only given: The nanoparticle field extraction thruster (NanoFET) is an electrostatic micro/nano-particle accelerator technology that is being developed for use as an electric propulsion system. Conceptually, NanoFET employs micro/nano-electromechanical systems (MEMS/NEMS) to transport, charge, and accelerate conductive particles. The propellant, via piezoelectric actuations, is fed from a storage reservoir through a charging grid that breaks up particle agglomerates. Above the charging grid, a stack of electrode gates is electrically biased to provide the necessary charging and accelerating electric fields, with charged particle passage through arrays of channels etched through the electrode stack. Particles can be charged to either polarity, so the need for a separate neutralizer is eliminated. Because the particulate propellant is electrostatically charged in NanoFET via contact with the charging electrode rather than ionized via electron impact collisions, the propellant's specific charge is readily adjustable. By changing the charging electric field or using particles of different densities or sizes, NanoFET can tune its propulsion performance for different mission needs. In addition, NanoFET may allow important advantages in terms of propellant storage and handling efficiency over gas or liquid propellant approaches. Micron-sized particles have been successfully transported, charged, and accelerated in the lab, and work is progressing towards scaling down the system to accommodate nano-particles. Key challenges to be addressed include overcoming inter-particle forces to permit acceleration of individual particles rather than agglomerations with a distribution of charge states and optimizing the allowable current density. [C633]

### "Design perspectives on 22nm CMOS and beyond"

This paper presents technology and economic challenges posed by 22 nm CMOS and beyond, and how they can be addressed by advances in design technology, validation, and testing, to exploit the benefits of scaling we have enjoyed over the decades. [C634]

### "Implementation of parallelization and nano simulation using multi-scale modeling on various HPC setups"

We have implemented multifarious aspects of nano simulation using multi scale modeling on various HPC (High Performance Computing) setups. Distribution of jobs from macro to nano scale has been shown which holds the essence of simulation at nano scale. This distribution is substantiated on MPI (Message Passing Interface) and PVM (Parallel Virtual Machine) on MATLAB, Linux and WCCS (Windows Compute Cluster Server) environments. In this paper we have shown the connections and a novel way of implementing multi scale computations on an HPC setup. We have also compared the implementation of MPI and PVM based HPC setup for MATLAB, Linux and WCCS environments. The selection criteria for identification and proposition of the tool, protocol and environment for an HPC setup plays an important role in deciding the tool to be used. Comparison of the advantages and disadvantages of each of the methodologies being put forward. MPI.NET was used under WCCS where C# was used. The latest versions were used for PVM Linux based setup where Open SUSE Linux was used as the operating system. The main two criteria user friendly and performance were compared and the recommendations are made for making the right balance between them. [C635]

### "A novel micro-structure internal antenna with sputter-deposited for wireless communication applications"

This research proposes a novel micro-structure sputter-deposited internal antenna for wireless communication applications. With the proposed antennas adapted micro and nano scale technology as well as sputter-deposited internal antenna covering GSM quad-band (GSM850/EGSM900 and DCS1800/PCS1900) and WCDMA dual-band (WCDMA850/1900). To present micro-structure Ni/Ag/Ni thin films overall size is 43.0times22.0times0.0015 mm3(Ni/Ag/Ni growth thickness: 15.0times103Aringring) without feeding mechanism. The optimized tri-structure antenna results of shows satisfied performance at GSM quad-band frequency using Agilent E5071B and CTIA chamber. This investigated proposes novel structure is very promising for the quad-band mobile antenna applications and further higher frequency operation of the wireless technology. [C636]

### "Silicon nano- and micro-photonics devices"

Silicon VLSI plays a key role in information technology. Recent progresses in silicon photonics have significantly moved the conventional silicon VLSI to high bandwidth photonics with lower power consumption for switching and interconnects. These devices include novel waveguides, modulators and detectors that are compatible with Si CMOS fabrication process. There are two major obstacles to build a monolithic nano-photonics system on a silicon chip: 1. lack of a silicon based light source and 2. silicon does not have any electro-optic (X2) effect. The combination of these two may require a hybrid integration in the foreseeable future. In this presentation, we will present the recent results and the projection of future development. [C637]



### "Silicone-based encapsulation of a cell culture measurement device under physiological conditions"

Impedance measurement with interdigitated electrode structures (IDES) is suitable for monitoring concentration and proliferation of adherent biological cells [1]. In some applications [2] the sensor interface has to be operated in the humid environment where the cells are cultivated. There, the combination of the ambient humidity with ionic contaminations of the electronic components causes a drift in the sensor signals. We present an encapsulation based on polydimethylsiloxane (PDMS), a silicone, which reduces humidity-induced drift of the sensor signals to values clearly below 1%. Affection of the cell culture media or the cell culture by gas emission of the cured PDMS was not observed. [C638]

### "Reliability modeling and optimization of MEMS elements in various devices using multi-scale concepts"

Diverse computational methods have brought powerful techniques to calculate reliability by multi scale modeling supported by experimental and theoretical methods. These approaches play an important role in micro electro mechanical systems (MEMS) technology where the analysis is based on abstraction level theories and no comprehensive explanation of nano scale phenomenon are proposed. It is proposed that high performance computing (HPC) if used with multi scale optimization library then the reliability calculation can be accelerated and also research in reliability of MEMS. In this work we have developed library where we can select the various physics at different level and then calculated reliability for better accuracy. In the proposed work, modeling and computation is performed using MATLAB distributed computing toolbox and Sugar MEMS simulation library. It is an extension to SUGAR package for MEMS. [C639]

### "Modeling Nano enabled elements of solar and fuel cell"

We have proposed a unified approach to the modeling and study of developments in the field of nanotechnology and its application in futuristic nano-enabled cells. The necessity of a nonporous membrane has been eminent in recent fuel cells. The need for MEMS based models for porous silicon based membranes based on nano imprints technology has been met by modeling it in SUGAR in MATLAB environment. We have identified and categorized the domains of Nano enabled solar cells and have put forth a proposition for multi scale modeling of solar cells. Multi scale modeling on HPC (high performance computing) of a nano enabled solar cell is shown under MCCS (Microsoft compute cluster environment) environment using extreme optimization numerical library is implemented. Distribution and performance analysis of four levels of computation in a multi scale model is implemented with the distribution being carried out from classical semi-conductor to quantum levels as to accurately predict the behavior and properties of the solar cell as per the needs of the engineering of devices. [C640]

### "Intricate modeling of HDD and reliability analysis in light of advances in Nanotechnology and MEMS"

We have demonstrated the impact of developments in nanotechnology to hard disk drive (HDD) technology. We have put forth a proposition to enhance the modeling of future storage devices based on innovations in the field of Nanotechnology and MEMS. We have elucidated the influence of recent advances of nano-composites, MEMS (micro electro mechanical systems) etc. and their implications towards the development of storage devices in the future. We have discussed about reliability modeling, nano-physics modeling and thin-film polymer modeling of HDD technology on computer-aided engineering tools such as Matlab. We have also devised a design of Nanotechnology and MEMS enabled future HDD. We have given a small model for array based MEMS cantilevers for HDD and have used SUGAR MEMS simulation library in Matlab to model it. We have included the parameters to be kept in mind while modeling a HDD in light of the innovations in Nanotechnology and MEMS. Finally we have stated the working of a MEMS-based actuator and presented its reliability modeling. [C641]

### "Multi Scale modeling and intricate study of MEMS based elements in RFID systems"

In this paper we have implemented some of the complex modeling aspects such as multi scale modeling, Matlab, sugar based modeling and have shown the complexities involved in the device modeling of nano RFID systems taking example of MEMS models. We have shown the modeling and simulation and demonstrated some novel ideas and library development for nano RFID and its extension for MEMS devices. Reliability and packaging still remains one the major hindrances in practical implementation of nano RFID based devices and multi scale analysis also can be used in that area. Therefore to work on it by modeling and simulation will play a very important role. Thus incorporating this we can design a nano-RFID which can be used in areas like human implantation and complex banking applications. We have proposed modeling of RFID using the concept of multi



scale modeling to accurately predict its properties for MEMS specific applications. Also we give the modeling of MEMS devices that are proposed recently that can see possible application in RFID. RF MEMS has been matured and its devices are being successfully commercialized but taking it to limits of nano domains and integration with singly chip RFID needs a practical modeling approach which is being proposed. We have modeled 2 MEMS based transponder and shown the distribution for multiscale modeling for nano RFID. [C642]

#### **"Hybrid servo design for large area nano pattern stitching"**

Interference Lithography offers a low-cost alternative to the next-generation lithography (NGL) technology. Using ultra-violet light, the interference lithography could produce patterns with nano meter feature sizes. Because the working area of the focused laser is usually very small, it is necessary to repeat the exposure for large area applications. This research presents a precision 2D servo system to patch the successive lithography patterns together. The period of the pattern from the interference lithography is 600 nm. To achieve seamless patching, the system has to achieve the same stitching accuracy throughout the entire the length of the lithography pattern. In this research, the servo control system achieves typically less than 20 nm overall stitching accuracy to patch the patterns together. [C643]

#### **"Integrating magnetics for on-chip power: Challenges and opportunities"**

Integration of efficient power converters requires a technology for efficient, high-power on-chip inductors. The state of the art is reviewed, and possible future developments are discussed for both air-core and magnetic-core inductors. Performance limits and scaling are analyzed. General design possibilities are outlined and different approaches are compared. Magnetic materials are reviewed, and nano-granular composite materials are highlighted as an attractive option. [C644]

#### **"Towards automatic control of scanning transmission electron microscopes"**

Scanning transmission electron microscopes are the tools of choice for material science research, since they provide information on the internal structure of a wide range of specimens. These sophisticated machines are operated manually by skilled technicians, who execute complex and repetitive procedures, such as measuring nano-particles, using mainly visual feedback. Hence, there is a need for new global control strategies to automate these procedures. These strategies, however, must be based on a firm understanding of the microscopes from the system theoretical perspective. To the best of our knowledge, such perspective is lacking in the literature. Thus, it is provided here through a new modeling framework that facilitates the future development of global control strategies. The paper also aims to introduce scanning transmission electron microscopy as an important and untapped area of application for control engineers. [C645]

#### **"A K-Delta-1-Sigma modulator for wideband analog to digital conversion"**

As CMOS technology shrinks, the transistor speed increases enabling higher speed communications and more complex systems. These benefits come at the cost of decreasing inherent device gain, increased transistor leakage currents, and additional mismatches due to process variations. All of these drawbacks affect the design of high-resolution analog-to-digital converters (ADCs) in nano-CMOS processes. To move towards an ADC topology useful in these small processes the K-delta-1-sigma (KD1S) modulator-based ADC was proposed. The KD1S topology employs inherent time-interleaving with a shared opamp and K-quantizing paths and can achieve significantly higher conversion bandwidths when compared to the traditional delta-sigma ADCs. The 8-path KD1S modulator achieves an SNR of 58 dB (or 9.4-bits resolution) when clocked at 100 MHz for a conversion bandwidth of 6.25 MHz and an effective sampling rate equal to 800 MHz. The KD1S modulator has been fabricated in a 500 nm CMOS process and the experimental results are reported. Deficiencies in the first test chip performance are discussed along with their alleviation to achieve theoretical performance. [C646]

#### **"Trend from ICs to 3D ICs to 3D systems"**

Moore's law has driven the IC industry to a billion transistor chip. But major technical and financial barriers are foreseen beyond 32 nm. One alternative path to this challenge seems to be stacked 3D ICs. But 3D ICs are a small part of any system and the total benefits of miniaturization cannot be realized until the entire system is miniaturized. This is the basis of 3D systems, the focus of this paper. The 3D miniaturization technologies briefly described in this paper include Si or wafer level interposers with Through-Package-Vias (TPV), nano-scale passives, thermal materials and interfaces and fine pitch system interconnections. [C647]

#### **"Development of microfluidic chips based on magnetic nano-materials in biomedical applications"**

Microfluidic devices appear to offer important opportunities for modern research, especially for the clinical



diagnosis, drug delivery and biomedicine research due to their numerous advantages, such as very low reagent consumption and waste generation, fast reaction time, high reaction efficiency and a large surface to volume ratio. Therefore, microfluidic have been paid much more attention by the researchers in recent years. Functionalized magnetic nano-particles can be used for a large number of microfluidic applications and have attracted a great attention during the last few years because of their unique properties of tunable anisotropic interaction. This paper reviews the development of microfluidic chips based on magnetic nano-materials in biomedical applications. The future research directions of microfluidic as well as their applications were also discussed. [C648]

#### "Indirect compensation techniques for three-stage CMOS op-amps"

As CMOS technology continues to evolve, the supply voltages are decreasing while at the same time the transistor threshold voltages are remaining relatively constant. Making matters worse, the inherent gain available from the nano-CMOS transistors is dropping. Traditional techniques for achieving high-gain by vertically stacking (i.e. cascoding) transistors becomes less useful in nano-scale CMOS processes. Horizontal cascading (multi-stage) must be used in order to realize high-gain op-amps in low supply voltage processes. This paper discusses new design techniques for the realization of three-stage op-amps. The proposed and experimentally verified op-amps, fabricated in 500 nm CMOS, typically exhibit 30 MHz unity-gain frequency, near 100 ns transient settling and 72deg phase-margin for 500 pF load. This results in significantly higher op-amp performance metrics over the traditional op-amp designs while at the same time having smaller layout area. [C649]

#### "A high dynamic range ASK demodulator for passive UHF RFID with automatic over-voltage protection and detection threshold adjustment"

This paper presents a passive UHF RFID ASK demodulator that operates over a +24 dBm to -14 dBm RF input power range. The demodulator automatically adjusts between high sensitivity mode for weak RF signal power and over-voltage protection mode for high RF power. The input over-voltage protection circuit is designed to protect the IC from high input power while not impacting the sensitivity at weak input power. The demodulator is comprised of a RF rectifier, a variable gain attenuator with automatic threshold adjustment and a nano-power data slicer. The demodulator handles demodulating signals with a minimum to maximum envelope ratio of 0.8 over the entire input power range, and the data slicer consumes only 160 nA from a 0.9 to 1.25 V rectified supply. The RFID chip is fabricated in a 0.13  $\mu\text{m}$  analog-CMOS technology and the entire chip occupies an area of 0.55 mm<sup>2</sup>. [C650]

#### "Femtosecond laser blackening of metals"

Using a femtosecond laser processing technique, we produce technologically important black metals (Au, W) and black Ti90/Al6/V4 alloy with absorptance of about 85-95% over a broad wavelength range from ultraviolet to infrared. From scanning electron microscopy we find that the enhanced absorption of the black metals is caused by a rich variety of nano- and microscale surface structures. The black metals produced in our study may find applications in photonics, plasmonics, stealth technology, airborne/spaceborne devices, broadband thermal radiation sources, solar energy absorbers, radiative heat transfer devices, thermophotovoltaics, and biomedicine. [C651]

#### "Crystal defects analysis using nano-probe technologies"

With the device size shrinking to deep sub-micron region, silicon crystal defects become critical to device parameters. It also brings FA (Failure Analysis) great challenges on timely and exactly identifying the defect by EFA (Electrical Failure Analysis) and PFA (Physical Failure Analysis) methods. In this paper, we report the FA's on the single bit failure of a 6T-SRAM using nano-probe technologies for electrical localization. PFA methods, such as SEM (Scanning Electron Microscope), TEM (Transmission Electron Microscope), and chemical etching were performed for failure visualization. [C652]

#### "Study on Dissolving Rules of Nano Particles from E. camaldulensis Wood Flour"

Now Eucalyptus wood begins to be used to pulp. The leaching rule of nano particles from E.camaldulensis wood has an important significance in the forestry research and paper making engineering. Therefore, based on the single-factor method, the fresh E. camaldulensis shavings were treated by LiOH in a concentration range of 0.5%~25% g/mL and the duration is 3, 16 and 24 hours respectively. The extraction mass was analyzed and the results were discussed. The filtrates were analyzed by ZETA and SIZER. The results were following as: (1) The extraction mass arrived at the maximum value when concentration is about 17.5%. (2)The micro/nano particles in the diameter of 531-1720 nm, 531-1720 nm, 164-531 nm is the most at the extracting time of 3h, 16h, 24h,



respectively (2) The diameter the micro/nano particles of wood extractives and hemicellulose is chiefly between 164-1720 nm according to number fraction. However, there are micro particles in the diameter of more than 1720 nm when LiOH concentration is bigger than 15%. The micro/nano particles in the diameter of 531-1720 nm, 531-1720 nm, 164-531 nm is the most at the extracting time of 3h, 16h, 24h, respectively. [C653]

#### **"A runout measurement technology with nanometer resolution for applications in hard disk drives"**

Hard disk production needs accurate and fast measurement technology to qualify the spindle system produced. This paper presents several new technologies to measure the runout of spindle motor used in hard disk drives. The limitations of these technologies in the precise measurement are analyzed in the paper. The testing results show that, the technology utilizing optical interference is a good approach to realize 1 nano meter accuracy with high measuring speed. The experimental studies on different type micro motor are also presented. [C654]

#### **"Implementation of WAP gateway technologies through wireless communication"**

The Wireless Application Protocol (WAP) is an emerging standard for the deployment of data oriented applications in wireless environments. Although some components of the WAP suite have been developed, it lacks a complete general architecture integrating all the protocols, software components of both the Internet and wireless contexts in a transparent way. The protocol stack consists of miniaturized versions of UDP, TCP, SLP and HTTP protocols with reduced header sizes and complexity to make the protocols usable in wireless sensor networks. This paper presents a general architectural framework to develop and deploy portable applications and services accessible by WAP compliant mobile terminals, extending end-to-end services between terminal and business applications. [C655]

#### **"ICCCN 2009 Conference Program"**

The following topics are dealt with: multimedia; QoS; Internet services; Internet systems; Internet applications; emerging wireless technologies; optical networking; wireless communication; signal processing; pervasive computing; grid networking; network architecture; network protocols; wireless ad-hoc networks; wireless sensor networks; peer-to-peer networking; network algorithms; performance evaluation; network security; network privacy; multimedia computing; multimedia communications; telecommunication networks; cognitive networks; cyber-physical networks; nano molecular networks; and quantum information networks. [C656]

#### **"Nano-Scale On-Chip Irregular Network Analysis"**

Shrinking CMOS feature sizes and the integration of novel nanotechnologies onto silicon platforms are both likely to increase fabrication defects. As a result, on-chip networks become more and more irregular due to defects and it becomes more challenging to map computation and data onto the networks. One way to overcome this challenge is to configure the irregular network into a more conventional regular topology. In this paper we analyze nano-scale on-chip irregular networks to determine the regular topology most similar to a given irregular network. The results show that an irregular network is most similar to a tree. Further analysis is conducted based on configuring an irregular network into a tree structure to show whether there are opportunities to utilize links that are not included in the tree. [C657]

#### **"Learning microelectronics through technology and research"**

The CoMSON project is a distributed European research project that combines research efforts from both academia and industry. This project is distributed among eight institutions across Europe. The aim of this project is to implement an experimental simulation platform (in software code) for devices in micro and nano-electronics with an integrated e-learning system. This project has two main goals. First, to train graduate students and post-docs in mathematical modeling, through the creation of this simulation platform, and second the delivery of this simulation platform to be used as a training tool for new recruits. In this paper we describe the information system architecture created to provide the partners with a strong collaborative and development research environment. This architecture provides a framework with three main goals: information sharing, collaboration in research and, training. This scheme easily allows users to access, update and interact with information and with other researchers within all the stages of the project. [C658]

#### **"Communication in macrochips using silicon photonics for high-performance and low-energy computing"**

In this paper microchip technology was explored. In order to scale chip-to-chip I/O to the required communication performance and energy, optical interconnects between chips based on CMOS-compatible silicon photonics was proposed. One key component is an inter-chip optical coupler supporting wavelength-division multiplexing



(WDM) functionality that enables face-to-face optical proximity communication (OPxC). The high-fidelity 10 Gb/s OPxC with reflecting mirrors micro-machined into silicon and co-integrated with low-loss SOI waveguides for packaged chip-to-chip communication was demonstrated. These devices were integrated through dry etching rib waveguides 8  $\mu\text{m}$  wide that tapered to 13  $\mu\text{m}$  wide and subsequently truncated with a wet-etched micro-mirror facet forming a 54deg angle with the (100) silicon surface. Light in waveguides on one chip can couple to waveguides on a second, facing chip upon face-to-face positioning so that the reflecting mirrors form a coupled pair and complete an OPxC hop. Inside a package, a chip-to-chip OPxC hop was measured to have optical coupling loss of 4dB; with precision aligned chips using a nano-positioning stage. When OPxC hops associated with the package are inserted into standard 10 Gbps links, it was shown that RMS jitter and amplitude metrics for data eye quality to be essentially unchanged (within 1%). This package-based self-alignment mechanism enables chip packages for many different classes of proximity communication. In this presentation, other critical components of chip-to-chip optical interconnects, including modulators and detectors, were also addressed.

[C659]

### "Modeling of Selective Carbon Nanotubes Growth for Non-classical Memory Applications"

Single wall carbon nanotubes (SWNT) have unique properties that make them potentially useful in wide variety of applications in nanoelectronics. However, these applications are feasible only if SWNTs have specific chirality. Therefore optimization of experimental conditions for Chemical Vapor Deposition (CVD) growth of SWNT in order to increase its selectivity is of great practical importance. This rational optimization is impossible without knowledge of mechanistic kinetics of CVD. It is not probably feasible to extract the information on mechanism for SWNT synthesis from experimental data. The chemical origin of the reaction barriers and intermediates, however, could be analyzed using molecular simulations. Here we propose multiscale computer modeling of CVD process. Our approach is to extract the structure of the intermediates from molecular dynamics trajectories, conduct the transition state search, predict the free energy activation barriers, build the kinetic model of the growth process, and implement it in kinetic Monte Carlo algorithm to predict the optimal experimental conditions necessary to produce desired chirality of SWNT. [C660]

### "Fabrication of Activated Carbon Electrodes by Inkjet Deposition"

The inkjet deposition technology turns out to be interesting in various applications when one attempts to reduce manufacturing costs, simplify technological steps, and implement materials that could not be deposited in any other way. One of the limitations however, is the issue raised by resolution which is directly linked to the ejection head manufacturing technology. In this paper, a method of activated carbon deposition based on inkjet is presented. Activated carbon is extensively used in chemistry for its impurity absorption capabilities and in other applications like the fabrication of supercapacitors. It is shown in particular that by using a localized surface treatment with OTS and an activated carbon suspension stabilized by a surfactant, one can get 10  $\mu\text{m}$  structures, which are, therefore, much smaller than the ejection head nozzle diameter. To implement and optimize the process, the contact angle measurement technique is utilized. [C661]

### "Leaky Coplanar Waveguide Antenna with Tunable Beamwidth and Radiation Angle Using Composite Right/Left-Handed Materials"

A new field of physics has appeared with the emergence of materials known as "left handed materials" (LHM) or "metamaterials". These materials show very particular characteristics. Their index of refraction has a negative value, which results in the reversal of Snell's law. Whereas, in traditional material the Poynting vector  $S$  always forms a right-handed triplet with  $E$  and  $H$  ( $S = E \times H$ ). In the left handed media, the Poynting vector  $S$  and the wave vector  $K$  are in opposite directions. Thus, the wave moves in the direction opposite to the direction of the energy flow: phase speed and group speed are anti-parallel. Therefore, a left-handed media is artificial and does not exist in nature. Indeed, when these materials are inserted into a guided wave device, one obtains the backward-wave effect. The goal of this work is to study more in details this physical phenomenon. To undertake this study, this paper presents also the design of a 10 GHz beam-scanning CPW-Antenna fabricated on metamaterial support. [C662]

### "Author Index"

{no data available} [C663]

### "RCS of circular carbon NANO tube antenna array"

A novel THz antenna structure, made of carbon nanotube arrays is suggested. Using CST MICROWAVE STUDIO (CST MWS), the capabilities of carbon nanotube terahertz (THz) antenna arrays have been simulated and this CNT antenna array has been fabricated. [C664]



### "Sensitivity analysis of the chip for REMS wind sensor"

The silicon chip designed and fabricated by Micro and Nano Technology Group from UPC which has been delivered to the remote environment monitoring station project is the fundamental element of the wind sensor of the meteorological station for Mars surface. The purpose of this article is to present a sensitivity analysis of the chip according to the harsh Martian environment and to indicate the true sensor ability for reliable wind speed and incidence angle measurements in strongly rarified carbon dioxide atmosphere of the "red planet". [C665]

### "Publisher's Information"

{no data available} [C666]

### "Emission of Nanosize Particles in the Process of Nanoclay Blending"

Blending is one of the dustiest operations in the process of developing new fire-safe polyurethane foams. This paper presents the results of an investigation of the emission of nanosize particles released Nanofilreg5 nanoclay is blended. Ten 5-20 g samples of Nanofilreg5 were blended for 30-204 s. The level of nanosize particles was monitored continuously over 3 days with a scanning mobility particle sizer (SMPS) with a long differential mobility analyser (DMA) to measure particle number size distributions in the 17-604 nm range and a P-TRAK ultrafine particle counter (UPC) to measure particle number concentrations in the 20-1000 nm range. The results showed that blending released 17-34 nm particles. The total number concentrations from the SMPS were compared with those from the P-TRAK; similar results were obtained. [C667]

### "Superior-Order Curvature-Corrected Logarithmic CMOS Nanostructure"

A new high precision superior-order curvature-corrected integrated nanostructure will be presented. In order to improve the temperature behavior of the circuit, a double differential structure will be used, implementing the linear and the superior-order curvature corrections. An original CTAT (complementary to absolute temperature) voltage generator will be proposed, using exclusively MOS transistors biased in weak inversion for a low power operation of the integrated nanostructure, having two great advantages: an important reducing of the circuit silicon area and an improved accuracy (matched resistors being replaced by matched MOS active devices). The superior-order curvature-correction will be implemented by taking the difference between two gate-source voltages of subthreshold-operated MOS transistors, biased at drain currents having different temperature dependencies: PTAT (Proportional To Absolute Temperature) and PTAT<sup>2</sup>. The SPICE simulations confirm the theoretical estimated results, showing a temperature coefficient under 9.4 ppm/K for an extended input range 173 K < T < 423 K and for a supply voltage of 2.5 V and a current consumption of about 1  $\mu$ A. [C668]

### "Large-Area Arrays of Pillar-Based Metal Nanostructures"

The fabrication method of metal nanostructure arrays on large-area (e.g., 4" in diameter) substrate is proposed and demonstrated. The method includes formation of self-organized mask, nanopillar preparation by reactive ion etching, and oblique angle metal deposition on the nanopillar sidewalls. The resulting structures have crescent shapes with controllable opening, thickness, diameter, and height. Due to geometrical asymmetry, the nanocrescents demonstrate anisotropy of optical properties and can be used in production of cheap and large-area metamaterials. [C669]

### "CrossBeam, Principles and Application"

The use of the focused ion beam (FIB) systems has increased to a high level in recent years. The imaging, milling, and deposition capabilities of the FIB make it the ideal instrument for e. g. site-specific failure analysis, specimen preparation and nano-machining. Ion channelling contrast allows for selective imaging of polycrystalline and poly-phase microstructures. In addition, the FIB and CrossBeamreg instruments are unique stand-alone analytical tools. Their vast capabilities have enabled numerous applications into the semiconductor and materials sciences applications. These integrated CrossBeamreg tools enable the observation and direct control of the FIB operation in real time. In addition to the improved accuracy and resolution the electron beam adds analytical capabilities as STEM, EDS and EBSD to the instruments. [C670]

### "Low-Field Microwave Phenomena in CoFeSiB Amorphous Magnetic Microwires"

Metallic microwires with ferromagnetic nature and amorphous structure have been prepared by rapid solidification and drawing. Their alloy composition and thickness, 1 to 30 micron diameter, can be tailored to exhibit outstanding properties. Particularly, non-magnetostrictive CoFeSiB alloy microwires exhibit giant-



magnetoimpedance effect while FeSiB alloy microwires show quite large Barkhausen magnetic jump. These properties make them very useful as sensing elements in particular magnetic, stress or temperature sensor devices. After presenting the general characteristics of investigated microwires, we introduce and analyse novel results about microwave absorption phenomena of such microwires in the low-DC field regime (units or tens of Oe). We have used two alternative techniques: i) Absorption measurements as a function of DC applied low-field using a spectrometer operating at X-band frequency of 9.8 GHz, and ii) Ferromagnetic resonance measurements in a network analyzer in the frequency range up to 20 GHz for different DC applied fields. The interpretation of results obtained by combination of the two techniques confirm that low-field microwave phenomena are associated with the low-field magnetization processes observed at low-frequency, which are determined by the particular magnetic anisotropy present in the microwires. This conclusion is similar to giant magnetoimpedance phenomena typically observed at lower frequency range. Results are also discussed in terms of the suitability to extend the working frequency to employ these microwires as sensing elements up to the gigahertz range. [C671]

### "Design for Manufacturability and Reliability in Nano Era"

The bottom line of any company is to maximize the profit from any given product. There are many factors influencing the product design resulting in a profitable business. One of the biggest factors is the manufacturability of the product. It is becoming more and more crucial to meet the 6+6 (6 months for the development and 6 months for qualifying the product to ship to customer) product life cycle to accommodate the rapid changing technology hungry market demand. Smooth, reliable, and efficient product ramp through manufacturing is the key of success for meeting TTM, capturing higher percentage of total available market (TAM). This tutorial is going to address the difficulties industries are facing today in designing manufacturing friendly highly complex giga-scale products in submicron technology. As we are heavily into deep submicron era, the error margin or the tolerance guard band is getting tighter and tighter with respect to the previous generation of fabrication process. On this note, it is important to pay attention to Design For Manufacturing (DFM) related issues early in the design cycle as oppose to later in the design. These include, however not limited to, all kinds debugging hooks in the design for easy debugging of billion of transistors in a given design, paying attention to manufacturing friendly physical design rules, making sure of adequate test coverage to toggle most of the design nodes, making sure optimal guard band is implemented for transistor degradation for the lifetime of the product, and last but not least, all reliability (ESD, EM/SH, LU, etc) related issues are resolved in pre-silicon design before Tape out. In the past, manufacturing issues were not given much attention; time has changed and designers must have to be more sensitive than ever before in addressing manufacturing related issues early in the design cycle. In a nut shell, this tutorial will capture the must have knowledge for design engineers (irrespective of front-end or-- back-end) who are involved in high performance VLSI design, as DFM features moving upstream in the design cycle. Audience will walk out with a good understanding on how to integrate specific manufacturing concerns into a product's design to obtain a product that is easier to manufacture with excellent overall quality in a shortest development time. [C672]

### "Synthesis of Silver Colloids: Experiment and Computational Model"

We summarize our recent results that model the formation of uniform spherical silver colloids prepared by mixing iso-ascorbic acid and silver-amine complex solutions in the absence of dispersants. We found that the experimental results can be modeled effectively by the two-stage formation mechanism used previously to model the preparation of colloidal gold spheres. The equilibrium concentration of silver atoms and the surface tension of silver precursor nanocrystals are both treated as free parameters, and the experimental reaction time scale is fit by a narrow region of this two-parameter space. The kinetic parameter required to match the final particle size is found to be very close to that used previously in modeling the formation of uniform gold particles, suggesting that similar kinetics governs the aggregation process. The model also reproduces semi quantitatively the effects of temperature and solvent viscosity on particle synthesis. [C673]

### "The Study of the Crystalline Structure of the Phases in the Al-Ni Alloys Ultra Rapid Solidification"

Melt-spinning and melt-extraction methods of rapid solidification have been applied on Al-Ni alloys in the lower and higher composition. For guiding appreciations of the peripheral speed of the cooling disk it is used the dependence between the thickness of the solidified fibers and the peripheral speed of the extraction disk. The cooling speed calculated on the basis of the thermo transfer coefficient in accordance with the thickness of the fibers has lead to values of the cooling speed of one million C/sec (fibers of 100 micro meters). Alloys with 1, 86% Ni content in pouring status and ultra rapid solidified have been analyzed from the point of crystalline structure. The paper is a short analysis of the use of the X-ray diffraction techniques for observing the effects of ultra rapid solidification in Al-Ni alloys. This technique permits to observe highlighting the imperfections in the crystal pattern. [C674]



### "Metamaterial-inspired engineering of antenna systems"

Summary form only given. A number of advances in the use of metamaterials and metamaterial-inspired structures to improve the overall efficiency and bandwidth performance of electrically small antennas (ESAs) in the VHF, UHF and microwave regimes will be reviewed. Metamaterials have led to a different paradigm for achieving electrically small radiating and scattering systems. Many of our initial electric and magnetic metamaterial-based ESA designs have been realized through the introduction of the corresponding metamaterial-inspired near-field resonant parasitic element antennas. Their further miniaturization at VHF and UHF frequencies has been enabled by introducing lumped elements as was done to achieve the highly subwavelength ENG, MNG, and DNG unit cells reported. Many of these metamaterial-inspired ESA designs have now been fabricated and tested. The measurement results are in very nice agreement with their predicted behaviors. These results will be presented and discussed. While these initial efforts emphasized high overall efficiencies without using any external matching networks, more recent resonant near-field parasitic designs have also explored how close their Q values can come to the Chu limit. Several of these ESA designs, their frequency bandwidths, and their associated Q values will be compared to various reported limits. It will also be shown that the corresponding active metamaterial element versions of these metamaterial-inspired ESA designs, i.e., replacing the internal passive elements in successful narrow bandwidth, high overall efficiency designs with active elements, could potentially have very large instantaneous bandwidths while maintaining their overall efficiencies even when they are very electrically small. Related active coated nano-sized particle designs at optical frequencies have led to highly sub-wavelength lasing systems and their proposed nano-sensor and nano-antenna applications. [C675]

### "Phenomenological considerations of resistively switching TiO<sub>2</sub> in nano crossbar arrays"

Within this paper we present the fabrication of nano crosspoint junctions and arrays with electron beam direct writing (EBDW). Reactively sputtered TiO<sub>2</sub> was incorporated as a resistively switching thin film and electrically characterized concerning its performance. These devices are suitable for novel non-volatile storage systems in form of resistive random access memories (RRAM). All used materials as well as the fabrication processes for the functional thin film are in good accordance with current and future CMOS technology and provide a way to achieve low cost, high density non-volatile memory. The experiments were performed with 100-100 nm<sup>2</sup> small single junctions and arrays with 200 nm wide wires. The results of the former prove a non-volatility for more than 10<sup>5</sup>s and a switching speed better than 10 ns for the SET- and RESET operation (from high to low resistance state and in reverse direction). The latter prove the direct addressability of junctions within an array. [C676]

### "Implementing brain-like systems using nano functional devices"

Despite their enormous computational powers, digital computers today are inferior to humans in such tasks, like seeing events happening in front, perceiving and recognizing them by intuition and association, and making a decision to take an immediate action. We are aiming to develop a new-paradigm computing system most suited to such human-like intelligent information processing by best utilizing the state-of-the-art silicon technology. For this end, we have developed a series of VLSI chips dedicated to specific brain-mimicking processing using digital, analog as well as mixed-signal circuit technologies. In this paper, we will discuss how nano devices could be utilized in this context. Such a brain-like system could be built by a vast-scale integration of nano functional devices having a simple correlation function arising from the resonance-type I-V characteristics along with a primitive memory function. Thanks to the majority-voting decision making principle, such a system could be made tolerable to device-level errors, thus presenting a promising opportunity for system applications of nano devices in the beyond CMOS era. [C677]

### "New MEMS technologies for integrated vehicle health management and fluid sensing applications"

The purpose of this paper is to present an embedded MEMS fluid sensing embedded detection system that incorporates new nondestructive inspection (NDI) sensors for the advancement of diagnostics, prognostics, and health management of complex aircraft system and hardware. With the advent of MEMS NDI sensors, it is now possible to embed these sensors for detection of fuel leaks, moisture intrusion, hydraulic fluid leaks and pressure loss across all aircraft environments. This new NDI embedded detection technology can be used to validate and improve (SHM) structural health management, and integrates concepts and hardware from MEMS and nano-optical technology with spectrometers and microfluidic and wireless capabilities. This paper highlights nano-inspection MEMS device (NIMD) concepts and their application to SHM system development. [C678]

### "Discussion of origins of high-density trap states in SIMOX wafers"

We have demonstrated that separation by implanted oxygen (SIMOX) wafers have high-density trap states in



silicon-on-insulator (SOI) layer, which are distributed within about 30 nm from the SOI/buried oxide (BOX) interface in the SOI layer, nano-scale roughness at SOI/BOX interface, and local stress near SOI/BOX interface. Meanwhile, it is reported by Bjorkman et al. that there is a correlation between the stress in the SiO<sub>2</sub> layer and the Si/SiO<sub>2</sub> interface state density at midgap. From these results, we elucidate mutual relationships between trap states, roughness, and local stress. We discuss origin of the high-density trap states from a point of the local stress. [C679]

#### **"Stable, low power and high performance SRAM based on CNFET"**

In this paper we investigate the electrical characteristics of carbon nanotube field effect transistor (CNFET) SRAMs. This analysis shows that in 32 nm technology node CNFET SRAM spends much less standby power and is more stable in read operation as compared with its Si-MOSFET SRAM counterpart. However, write static noise margin (SNM) in CNFET SRAM is very low so two SRAM designs based on backgate voltage and diameters of CNFET have been proposed to improve write SNM in CNFET SRAMs. This investigation shows that access time for a 128 column-256 row SRAM array based on CNFET is improved over its Si-C counterpart. [C680]

#### **"A nano-functional-device-based image feature extraction circuitry with current-balancing feedback"**

An image feature extraction VLSI architecture using resonance current-voltage (I-V) characteristics has been proposed aiming at demonstrating a new potentiality of nano functional devices for use in building human-like intelligent systems. In this work, the resonance characteristics of nano devices have been emulated by CMOS inverter-based convolution circuits and directional edge filtering was carried out by subthreshold operation of CMOS circuits. In order to retain only essential features in the input image, a current-balancing feedback circuitry has been explored. The circuit can select relatively significant edges and leave them as digital flags autonomously. In order to verify the concept, a small-scale circuit was designed in a standard 0.18-μm CMOS technology, and its correct operation was confirmed by SPICE simulation. [C681]

#### **"A scalable architecture of associative processors employing nano functional devices"**

A methodology for building a low-power high-capacity associative processor system employing nano functional devices has been proposed. The study is a demonstration of how to use nano-scale devices in building practical applications, particularly in building associative processors. Characteristics of such devices are utilized for similarity evaluation and emulated by a simple NMOS circuitry. The concept has been verified by experimental results obtained from the real working proof-of-concept chip fabricated in a 0.18-μm CMOS technology. [C682]

#### **"Interactive Virtual Reality Simulation for Nanoparticle Manipulation and Nanoassembly using Optical Tweezers"**

Nanotechnology is one of the most promising technologies for future development. This paper proposes virtual reality (VR) as a tool to simulate nano particle manipulation using optical tweezers towards achieving nano-assembly and to handle effectively issues such as difficulty in viewing, perceiving and controlling the nano-scale objects. The simulation modeled using virtual reality displays all the forces acting on nanoparticle during the manipulation. The simulation is developed for particles that belong to the Rayleigh region and represents interactions of OT (a laser beam) with the nanoparticle. The laser beam aimed on to the nanoparticle traps the particle by applying optical forces. The trapped particle is then moved by moving the laser beam. The proposed VR based simulation tool with its capabilities can be easily extended and used for creating and open system framework by connecting it to a real OT setup to control nanoparticles manipulation. In addition, a feedback system can be build to increase of precision of movement. [C683]

#### **"Degradation of Mechanical Strength at Si/SiO<sub>2</sub> Interface on SOI Wafers under Cyclic Loading"**

Fatigue tests of silicon stepped cantilevers fabricated from silicon on insulator (SOI) wafers were conducted under the bending mode to evaluate the effect of cyclic loading on fractures occurring in silicon and Si/SiO<sub>2</sub> interfaces. The specimen in the quasi-static mode fractured at the stress concentration site on the silicon specimens. However, during the fatigue tests the cantilever broke after 104 cycles with stress amplitude of nearly half of the bending strength at the fixed end comprising the Si/SiO<sub>2</sub> interface. The results demonstrated that the cyclic stress durability in the Si/SiO<sub>2</sub> interface is significantly lower than that of the silicon body. [C684]

#### **"Giant Piezoresistance of Nano-Thick Silicon Induced by Interface Electron Trapping Effect"**

Both n- and p-type nano-thick piezoresistors are fabricated on SOI (silicon on insulator) wafers using micro-fabrication processes. Giant piezoresistance is measured and theoretically explained for nano-thick silicon



resistors. Compared to bulk silicon, one order of magnitude higher piezoresistive coefficients are, for the first time, tested with 13 nm-thick n-type and 9 nm p-type samples. Surpassing 2-D quantum effect, Si-SiO<sub>2</sub> interface electron trapping effect dominates the giant piezoresistance. Different from equivalent mobility change in conventional piezoresistance of bulk silicon, the giant piezoresistance come from carrier concentration change and have the same effect on the longitudinal and transverse piezoresistors. [C685]

#### **"Damage-Free Plasma Etching Processes for Future Nanoscale Devices"**

For the past 30 years, plasma etching technology has led in the efforts to shrink the pattern size of ultra-large-scale integrated (ULSI) devices. However, inherent problems in the plasma processes, such as charge buildup and UV photon radiation, limit the etching performance for nanoscale devices. To overcome these problems and fabricate sub-10-nm devices in practice, neutral-beam etching has been proposed. In this paper, we introduce the ultimate etching processes using neutral-beam sources and discuss the fusion of top-down and bottom-up processing for future nanoscale devices. Neutral beams can perform atomically damage-free etching and surface modification of inorganic and organic materials. This technique is a promising candidate for the practical fabrication technology for future nano-devices. [C686]

#### **"Implementation and control of a reconfigureable 4-tetrahedral robot"**

This work describes the implementation and control of a 4-Tetrahedron walker. The hardware selection in building the robot will be covered. Both mechanical systems and the electronic control systems will be discussed in detail. This work is part of the contribution of the Hope College team to the development of tetrahedron walker robots by the ANTS (Autonomous Nano-Technology Swarm) group at Goddard Space Flight Center, NASA. [C687]

#### **"A universal level converter towards the realization of energy efficient implantable drug delivery Nano-Electro-Mechanical-Systems"**

Nano-Electro-Mechanical-Systems (NEMS) are a technological solution for building miniature systems which can be beneficial in terms of safety, efficacy, or convenience. Thus investigation is necessary for their usefulness in drug delivery. In order to be an effective and reliable implantable system the DDNEMS (Drug Delivery Nano-Electro-Mechanical-System) should have low power dissipation, fault tolerance, and reconfigurability capabilities. In this paper we introduce a DDNEMS architecture, identify its major components, and propose the design of the crucial component universal (voltage) level converter (ULC). The ULC is a unique component that will reduce dynamic power and leakage of DDNEMS while facilitating its reconfigurability. The ULC is capable of performing level-up and level-down conversions and can block an input signal. We have prototyped a ULC using 32 nm high-K/metal-gate nano-CMOS technology with dual-VT technique. The robustness of the design is tested by carrying out three types of analysis, namely: parametric, load and power. It is observed that the ULC produces a stable output for voltages as low as 0.35 V and loads varying from 50 fF to 120 fF. The average power dissipation of the proposed level converter with a 82 fF capacitive load is 5muW. [C688]

#### **"Variability-aware optimization of nano-CMOS Active Pixel Sensors using design and analysis of Monte Carlo experiments"**

We propose a novel design flow for mismatch and process variation aware optimization of nanoscale CMOS active pixel sensor (APS) arrays. As a case study, an 8 times 8 APS array is designed using the proposed methodology for 32 nm CMOS technology. Performance metrics such as power, output voltage swing, dynamic range (DR) and capture time (delay) have been measured. The baseline results show a power consumption of 16.32 muW, output voltage swing of 428 mV, dynamic range (DR) of 59.47 dB and a capture time of 5.65 mus. The baseline APS array is subjected to 5% "intra-pixel" mismatch and 10% "inter-pixel" process variation and the effect on power and output voltage swing has been observed. The APS array is subjected to a design and analysis of Monte Carlo experiments based optimization. Using this approach, we have been able to achieve 21% reduction in power (including leakage). To the best of our knowledge, this is the first ever nano-CMOS implementation of an APS array optimized to be mismatch and process variation tolerant. [C689]

#### **"A PVT aware accurate statistical logic library for high-k metal-gate nano-CMOS"**

The semiconductor industry is headed towards a new era of scaling and uncertainty with new key building blocks for the next-generation chips, the high-kappa metal-gate transistor. There is a need for statistical characterization of high-kappa metal-gate digital gates as a function of process parameter variations to make them available for designers. In this paper, we present a methodology for PVT aware high-kappa metal-gate logic library creation while considering the variability effect in 15 parameters. First, statistical models for GIDL



current ( $I_{circGIDL}$ ), offcurrent ( $I_{circoff}$ ) and drive current ( $I_{circON}$ ) are presented at the device level. This is followed by statistical characterization of logic cells at roomtemperature. Data for subthreshold current ( $I_{circsub}$ ),  $I_{circGIDL}$ , dynamic current ( $I_{circdyn}$ ) and delay is presented. This is followed by results for PVT aware characterization of logic cells. To the best of the authors' knowledge, this is the first research which provides a PVT aware statistical characterization for high-kappa metal-gate nano-CMOS based logic gates. [C690]

### "Encoding Subsystem Codes with and without Noisy Gauge Qubits"

In this paper, we investigate a rather neglected aspect of subsystem codes viz. that of encoding. We show that encoding of subsystem codes can be reduced to encoding of a related stabilizer code making it possible to use the known results on encoding of stabilizer codes. Along the way we also show how Clifford codes can be encoded. These encoding schemes can tolerate initialization errors on the gauge qubits. This tolerance can be traded for reduced encoding complexity. [C691]

### "Spin-Chains as Quantum Channels for Qubit-State Transfer"

In this paper, we provide a simple strategy to optimize the performances of a spin chain as a quantum channel for state transfer. We investigate the most general conditions under which a long range interacting chain achieves the highest fidelity and the shortest transfer time. In this respect, we show that the symmetry of the spin chain plays a key role to identify the ideal system, which involves sender and receiver only, and provide numerical evidence. However, the two-spin ideal chain is unpractical due to the decrease of the coupling strength with distance. Therefore we show how to design a spin chain, which nearly approaches the optimal behaviour, while keeping the interaction strength still reasonably high. [C692]

### "Eavesdropping of Two-Way Coherent-State Quantum Cryptography via Gaussian Quantum Cloning Machines"

We consider one of the quantum key distribution protocols recently introduced in Ref. [Pirandola et al., Nature Phys. 4, 726 (2008)]. This protocol consists of a two-way quantum communication between Alice and Bob, where Alice encodes secret information via a random phase-space displacement of a coherent state. In particular, we study its security against a specific class of individual attacks which are based on combinations of Gaussian quantum cloning machines. [C693]

### "On/off Detection Method for Reconstructing the Statistics of Quantum Optical States: An Overview"

We give a brief overview of the demonstration of a photon statistics reconstruction method based on Maximum Likelihood estimation and on/off detection. This method has been successfully applied to a large number of cases and, recently, extended to a scheme for a full reconstruction of the density matrix. Experimental results concerning the heralded single-photon state and the seeded parametric down-conversion are presented in some details. [C694]

### "Six Conjectures in Quantum Physics and Computational Neuroscience"

A paradox on Hilbert's problem 6 is identified. To avoid the paradox, equilibrium-based YinYang bipolar sets and bipolar dynamic logic (BDL) are introduced. Bipolar quantum entanglement is defined. BDL leads to a bipolar axiomatization for physics. Applicability of BDL is discussed. Six conjectures in quantum physics and computational neuroscience are posted. [C695]

### "The Quantum Locker Puzzle"

The locker puzzle is a game played by multiple players against a referee. It has been previously shown that the best strategy that exists cannot succeed with probability greater than  $1 - \ln 2 \approx 0.31$ , no matter how many players are involved. Our contribution is to show that quantum players can do much better---they can succeed with probability 1. By making the rules of the game significantly stricter, we show a scenario where the quantum players still succeed perfectly, while the classical players win with vanishing probability. Other variants of the locker puzzle are considered, as well as a cheating referee. [C696]

### "The GHZ State in Secret Sharing and Entanglement Simulation"

In this note, we study some properties of the GHZ state. First, we present a quantum secret sharing scheme in which the participants require only classical channels in order to reconstruct the secret; our protocol is significantly more efficient than the trivial usage of teleportation. Second, we show that the classical simulation of



an  $n$ -party GHZ state requires at least  $n \log_2 n - 2n$  bits of communication. Finally, we present a problem simpler than the complete simulation of the multi-party GHZ state, that could lead to a no-go theorem for GHZ state simulation. [C697]

### "All Languages in NP Have Very Short Quantum Proofs"

In this paper, we show that all languages in NP have logarithmic-size quantum proofs which can be verified provided that two unentangled copies are given. More formally, we introduce the complexity class  $\text{QMAlog}(2)$  and show that  $3\text{COL} \in \text{QMAlog}(2)$ . To obtain this strong and surprising result we have to relax the usual requirements: the completeness is one but the soundness is  $1 - 1/\text{poly}$ . Since the natural classical equivalent of  $\text{QMAlog}(2)$  is uninteresting (it would be equal to P), this result, like many others, stresses the fact that quantum information is fundamentally different from classical information. It also contributes to our understanding of entanglement since  $\text{QMAlog} = \text{BQP}$ . [C698]

### "Quantum-Zeno Control of Collisional Entanglement in a Bose-Josephson Junction"

We propose a scheme to control the collision-induced entanglement between atoms in the two-site Bose-Hubbard model, by means of site-indiscriminate noise. This decoherence mechanism induces the continuous measurement of the quasi-momentum, protecting single-particle coherence via a Bose-enhanced many-body Quantum-Zeno effect. [C699]

### "Does Quantum Mechanics Need Interpretation?"

Since the beginning, quantum mechanics has raised major foundational and interpretative problems. Foundational research has been an important factor in the development of quantum cryptography, quantum information theory and, perhaps one day, practical quantum computers. Many believe that, in turn, quantum information theory has bearing on foundational research. This is largely related to the so-called epistemic view of quantum states, which maintains that the state vector represents information on a system and has led to the suggestion that quantum theory needs no interpretation. I will argue that this and related approaches fail to take into consideration two different explanatory functions of quantum mechanics, namely that of accounting for classically unexplainable correlations between classical phenomena and that of explaining the microscopic structure of classical objects. If interpreting quantum mechanics means answering the question, "How can the world be for quantum mechanics to be true?", there seems to be no way around it. [C700]

### "Experimentally Testable State-Independent Violation of Bell-Type Inequalities for Quantum Contextuality"

There are experimentally testable correlation Bell inequalities which are satisfied by any noncontextual theory but are violated by any quantum state. We discuss how to test one of them. [C701]

### "Spectral Characterisation of Spontaneous Parametric-Down Conversion Entangled Photons Source in Femtosecond Pulsed Regime"

We report on experimental measurements of coincidence and single particle spectral shapes of biphoton signals when frequency entangled states are generated by SPDC crystals pumped by short pulses. It is shown evidence for biphoton coincidence spectrum narrower and single-particle one wider than the pump spectrum, with a large contrast between coincidence and singles distributions. The investigation of biphoton correlations has been performed by fixing one monochromator at the maximal transmission wavelength on down-converted signal gate and scanning the one placed in the idler branch in order to observe the spectral distribution of single counts and coincidences. The degree of entanglement is evaluated by the ratio of the FWHM of single particle and coincidence distributions: the greater the ratio, the greater is the entanglement. The degree of entanglement in frequency variables can be very high: it increases linearly with the length of the crystal, and decreases with the growing pump pulse. [C702]

### "An Efficient Method to Convert Arbitrary Quantum Circuits to Ones on a Linear Nearest Neighbor Architecture"

A variety of quantum circuits have been designed. Most of them assume that arbitrary pairs of qubits can interact. However, several promising implementations of quantum computation rely on a Linear Nearest Neighbor (LNN) architecture, which arranges quantum bits on a line, and allows neighbor interactions only. Therefore, several specific circuits have been designed on an LNN architecture. However, a general and efficient conversion technique for an arbitrary circuit has not been established. Therefore, this paper gives an efficient method that converts an arbitrary quantum circuit to one on an LNN architecture. Our method achieves small overhead and



time complexity compared with naive techniques. To develop the method, we introduce two key theorems that may be interesting on their own. In addition, our method also achieves smaller overhead for some known circuits designed on an LNN architecture. [C703]

### "Game-Theoretic Security Analysis of Quantum Networks"

Unconditional security is the key-feature of quantum cryptography, which makes it superior to any classical encryption scheme. Most research in this area focuses on analyzing the theoretical properties and performance of particular quantum key distribution protocols, but a rigorous analysis on the network level seems to be missing. We present a game-theoretic approach which gives simple and tight bounds to the risk of communication that any two peers in a quantum network have to take when communicating, even if quantum cryptography is used. This work is motivated by recent (IM)possibility results regarding unconditionally secure message transmission in arbitrary networks, which puts stringent constraints on the network topology. Hence, our model naturally accounts for a given graph topology (existing fibre-optic networks which are natural candidates for a roll-out of a quantum network), as well as measuring risk in terms of probability or the designers subjective understanding. As a by-product, our model gives optimal path selection strategies, and the optimal design of network topologies under given constraints (like geographic or monetary ones). [C704]

### "Preface"

{no data available} [C705]

### "Heat Transfer in Thin Films"

Heat transfer in thin films treats phonons as particles in the Boltzmann Transport Equation (BTE). However, phonons only allow slow thermal response. Rapid film heat transfer is possible provided films are allowed to promptly emit non-thermal electromagnetic (EM) radiation. Quantum mechanics (QM) used in the response of nanoparticles (NPs) is extended to thin films through the theory of QED induced EM radiation. Here QED stands for quantum electrodynamics. Atoms in thin films are generally under EM confinement at vacuum ultraviolet (VUV) levels that by QM are restricted to vanishing small levels of thermal kT energy, and therefore heat gain cannot be conserved by an increase in temperature. Heat is low frequency EM energy, and therefore the gain is conserved by VUV emission following QED induced up-conversion to the VUV confinement frequency of the film. The effective conductivity appears reduced only because EM emission is excluded from the heat balance. If included, the film maintains bulk conductivity through the thickness. The generality of QED induced EM radiation in thin films is extended to NPs that enhance heat transfer in nanofluids and as nanocatalysts increase the rate of chemical reactions. [C706]

### "An Error Model to Study the Behavior of Transient Errors in Sequential Circuits"

In sequential logic circuits the transient errors that occur in a particular time frame will propagate to consecutive time frames thereby making the device more vulnerable. In this work we propose a probabilistic error model for sequential logic that can measure the expected output error probability, given a probabilistic input space, that account for both spatial dependencies and temporal correlations across the logic, using a time evolving causal network. We demonstrate our error model using MCNC and ISCAS benchmark circuits and validate it with HSpice simulations. Our observations show that, significantly low individual gate error probabilities produce at least 5 fold higher output error probabilities. The average error percentage of our results with reference to HSpice simulation results is only 4.43%. Our observations show that the order of temporal dependency of error varies for different sequential circuits. [C707]

### "Nano Tungsten Carbide Supported on Carbon from Palm Kernel Shell in Remediation of Chlorofluorocarbon (CFC12)"

The widespread applications of chlorofluorocarbon (CFC) in industry including refrigeration, foam blowing agent and cleaning agent cause severe damage to the ozone layer and might contributed to global warming. Various methods were developed to find CFC alternatives or its environmentpsilas destruction. Among them catalytic conversion of CFCs into valuable compounds like hydrofluorocarbon (HFC) is most promising. It was observed that tungsten carbide (WC) catalyst has high potential in this hydrodehalogenation (HDH) process in remediation of CFCs. To improve reactivity, it is encourage preparing WC catalyst with high surface area. This study however has succeeded in developing high surface area tungsten carbide catalyst for the catalytic HDH of dichlorodifluorocarbon (R-12) using prepared activated carbon from waste palm kernel shell. This prepared catalyst is an economical, alternative route for production of tungsten carbide with high selectivity product towards HFC-32 which has zero ozone depletion potential (ODP). [C708]



### "All optical switching in silicon-on-insulator photonic wire nano-cavities"

All-optical switching with a very low power is demonstrated on photonic crystal wire nanocavities on silicon-on-insulator with large quality factors and high transmission in the telecom range. [C709]

### "Oblivious Transfer a la Merkle"

Oblivious transfer (OT) is a fundamental primitive in cryptography. It is known that unconditionally secure OT is impossible, even with the help of quantum mechanics. Furthermore, no classical OT scheme has been proven to offer computational security in the usual super-polynomial model, and there is evidence that such schemes cannot be based on one-way permutations. Nevertheless, inspired by Ralph Merkle's 1974 key distribution scheme, we offer a novel classical OT scheme based on one-way permutations and prove its polynomial security: the effort to cheat it scales as  $t^{3/2}$ , where  $t$  is the legitimate effort needed to implement it. Unfortunately, our scheme melts down under the onslaught of a quantum adversary after an effort merely in the order of  $t^{5/6}$ , so that it is actually easier to subvert it than to use it legitimately! By allowing the honest parties to use quantum computation as well, however, it may be that our OT scheme can be repaired so as to resist modest quantum attacks. [C710]

### "Single Ended Static Random Access Memory for Low-Vdd, High-Speed Embedded Systems"

Single-ended static random access memory (SE-SRAM) is well known for their tremendous potential of low active power and leakage dissipations. In this paper, we present a novel six-transistor (6T) SE-SRAM bitcell for low-Vdd and high speed embedded applications with significant improvement in their power, performance and stability under process variations. The proposed design has a strong 2.65 times worst case read static noise margin (SNM) compared to a standard 6T SRAM. A strong write-ability of logic 'one' is achieved, which is problematic in SE-SRAM cells even at lower voltage. The proposed bitcell design is mainly targeted for word-organized SRAMs. A 16 times 16 times 32 bit SRAM with proposed and standard 6T bitcells is simulated (including parasitics) for 65 nm CMOS technology to evaluate and compare the different performance parameters, such as, read SNM, write-ability, access delay and power. The dynamic and leakage power dissipation in the proposed 6T design is reduced by 28% and 21%, respectively, as compared to standard 6T design. [C711]

### "Open-Loop Control of Particle Systems Based on a Model of Coupled Stochastic Oscillators"

This paper presents an open-loop control method for particle systems which are modeled as coupled stochastic oscillators. The proposed control approach is flatness-based control. It is explained that the kinematic model of the particles can be derived from the model of the quantum harmonic oscillator. It is shown that the kinematic model of the particles is a differentially-flat system. It is also shown that after applying flatness-based control the mean of the particle system can be steered along a desirable path with infinite accuracy, while each individual particle can track the trajectory within acceptable accuracy levels. [C712]

### "Statistical Analysis of QKD Networks in Real-Life Environments"

The aim of this paper is to show that external influences like temperature, humidity, sunshine duration and global radiation have effect on the quality of quantum key distribution (QKD). It will be explained how the qubit error rate is correlated to these external influences. The correlations between the different influences will be analyzed using statistical methods, in particular generalized linear models. [C713]

### "Title Page i"

The following topics are discussed: quantum technologies; nanotechnologies; microtechnologies; quantum cryptography. [C714]

### "Fabrication and Testing of a TMMF S2030 Based Micro Fluidic Device for Single Cell Analysis"

Current paper describes the fabrication and testing of a Lab-on-a-chip device using TMMF S2030 dry film resist for single cell analysis. The device typically consists of a bigger channel (20  $\mu\text{m}$  deep), 3 smaller channels (2  $\mu\text{m}$  deep) with embedded reservoir in between and a detector towards the downstream. Whole device has been fabricated on a standard glass wafer. Electrode configuration is the notable factor in which pre-sorter electrodes were introduced to bring far-off particles to the trapping range. Dielectrophoresis technique will be used to trap a single particle/cell within the reservoir. Bigger channels were fabricated in TMMF and that of the smaller channels in silicon dioxide. Testing of the channels as successfully done using carboxylate modified fluorescent polystyrene beads (wavelength 605 nm). Currently we are working towards trapping a tumor cell and study the



viability and detection mechanisms. [C715]

### "Micromotor of Less Than 1 mm<sup>3</sup> Volume for In Vivo Medical Procedures"

The body's stress response to surgery has been cited as a primary cause of post-operative morbidity and has prompted growth in minimally invasive surgical techniques. The future of such techniques lies in the use of in vivo procedures, but is currently limited by the availability of motors with a volume of less than 1 mm<sup>3</sup>. In response to this we present a piezoelectric ultrasonic resonant micromotor with a volume of approximately 0.75 mm<sup>3</sup>. The motor has a novel helically cut stator that couples axial and torsional resonant frequencies, excited by a lead zirconate titanate element 0.03 mm<sup>3</sup> in volume. The motor performance reaches a start-up torque of 47 nNm and no load angular velocity of 830 rad/s. This gives the motor a power density of 18.4 kW/m<sup>3</sup>. This performance is on the order necessary to propel a swimming microbot in small human arteries. [C716]

### "Efficient Frequency Converters Based on Stimulated Raman Scattering in Hollow Core Photonic Crystal Fibres Filled with Nonlinear Liquids"

Recent developments in the field of nonlinear optics with photonic crystal fibers have led to the realization of supercontinuum spectra or parametric sources of correlated photons. However the nonlinearities were still limited by the use of silica. Hollow core photonic crystal fibers (HCPCF) filled with highly nonlinear liquids or gases enable the implementation of more performing nonlinear devices and open the scope of potential applications thanks to the large variety of usable liquids and gases. Moreover liquid and gas filled HCPCF present several original propagation properties such as transmission bands that can be tailored to favor or prevent a given nonlinear mechanism. In this work we will show that the on-purpose limited transmission band enables a high conversion efficiency towards a single Stokes component even at high pump intensities. Moreover such Raman converters generate single spatial mode at specific wavelengths that can be determined to fit desired applications. [C717]

### "Adaptive Error Correction with Dynamic Initial Block Size in Quantum Cryptographic Key Distribution Protocols"

We present an extension to the error correction facility that is at the core of classical quantum cryptographic key exchange in the spirit of the BB84 protocol. The Cascade error correction scheme proposed along with the experimental implementation of BB84 can significantly be improved by endowing it with an adaptive initial block size selection strategy that takes into account information from past protocol executions. Additionally, our model comes with learning capabilities enabling the protocol to adapt itself not only according to its past, but also to different environmental conditions which the link is subject to. At the same time, the procedure can widely be automated and can be implemented using known algorithms. We demonstrate the feasibility and efficiency of our proposal using experiments, comparing the classical approach to the dynamic extension, showing a significant efficiency benefit that we gain from an adaptive initial block size choice. [C718]

### "Title Page iii"

{no data available} [C719]

### "Copyright Page"

{no data available} [C720]

### "SSL/TLS with Quantum Cryptography"

The current standard to exchange a secret key for ensuring secure data transmission within the SSL/TLS protocol is based on Public-Key encryption. This method is only secure as long as the computation power of a potential attacker is limited. So far, the only way to make an unconditional secure key exchange, is to use quantum key distribution (QKD). With the latest figures of sifting key rates provided by NIST, we show which authentic theoretical final key rates are possible. Furthermore we present a modified SSL/TLS protocol, which uses quantum key distribution, in different encryption variants. [C721]

### "Wet chemical method to etch sophisticated nanostructures into silicon wafers using sub-25nm feature sizes and high aspect ratios"

There are a number of emerging technologies such as metamaterials, photonic wave-guides, nano-imprint lithography (NIL), field emission devices and through silicon via (TSV), that require high resolution and high aspect ratio nanofabrication techniques for good performance. Unfortunately, current nanofabrication techniques,



including photolithography and e-beam lithography, are limited to low aspect ratios on the order of 7:1 and cannot fabricate the high aspect ratio nanostructures needed for these emerging nanotechnologies. Deep reactive ion etching has traditionally been used to increase the aspect ratio nanostructures produced from traditional lithography techniques; however, the process is expensive, time consuming and cannot produce smooth sidewalls, lowering device performance. To overcome these obstacles our group has developed a new wet chemical nanofabrication technique that uses shaped catalysts to etch high aspect ratio nanostructures into silicon. The process is fast, does not require expensive equipment and has been used to produce features less than 25 nm wide, 25  $\mu\text{m}$ s long and microns deep in silicon using nanorod catalysts. 10 nm wide features were also fabricated using nano-donuts. This new, patented technique is compatible with existing silicon fabrication technologies and could be used for a wide variety of applications that require nanometer sized features and high aspect ratios. [C722]

### "Packaging and interconnect technologies for the development of GaN nanowire-based light emitting diodes"

c-axis oriented GaN nanowires (NWs) grown on Si(111) using nitrogen plasma assisted molecular beam epitaxy (MBE) offer promising new approaches for realizing efficient LED technology. The nanowires grow remarkably free of defects, suggesting that eventual LED structures may operate with high quantum efficiencies. Furthermore, the dense NW morphology offers LED configurations with high light extraction efficiency compared to conventional planar LED structures. Interconnecting these vertically aligned nanowires is challenging because of their small diameters, extremely high aspect ratios, and random distributions on the substrate. We have developed novel packaging and interconnection methods by atomic layer deposition (ALD) multilayer encapsulation of the nanowires with 50 nm thick alumina layers and 40 nm thick tungsten layers. This nano-scaled multilayer also provides efficient thermal connections that are mechanically reliable. These encapsulated NWs were used as thermal test structures and the temperature dependence of the photoluminescence peak position as recorded from the portions of the nanowire protruding from the encapsulation was used to monitor the sample temperature. In principle, the internal junction-to-substrate thermal resistance of eventual NW LED structures could be reduced by 400 times by electroplating copper into the interstitial regions between the NWs. These novel packaging and interconnect technologies developed for GaN nanowire-based LEDs can be applied to many other nanowire-based microsystems. [C723]

### "Green" nanocomposites for electronic packaging

This paper examines the use of nanocomposites in the area of "green" technology. A variety of green materials for advanced organic packaging have been developed. These include capacitors and resistors as embedded passives, resin coated Cu (RCC) as buildup layers, highly conducting nano-micro media for Z-interconnects, lead free assembly paste, ZnO based additives and magnetic materials. Nanocomposites can provide high capacitance densities, ranging from 5 nF/inch<sup>2</sup> to 25 nF/inch<sup>2</sup>, depending on composition, particle size and film thickness. The electrical properties of capacitors fabricated from BaTiO<sub>3</sub>-epoxy nanocomposites showed a stable capacitance over a temperature range from 20degC to 120degC. A variety of printable discrete resistors with different sheet resistances, ranging from 1 ohm to 120 Mohm, processed utilizing a large panel format (19.5 times 24 inches) have been fabricated. Low resistivity nanocomposites, with volume resistivity in the range of 10-4ohm-cm to 10-6ohm-cm depending on composition, particle size, and loading can be used as conductive joints for high frequency and high density interconnect applications. A variety of metals including Cu, Ag, LMP (low melting point) and LMP-coated Cu fillers have been used to make halogen free, lead free electrically conducting adhesive technology as an alternative to solders. Halogen free resin modified with ceramics/organic particles can produce low Dk resin coated Cu (RCC) with Dk value in the range between 4.2 and 3.2. Similarly, low loss RCC materials can be produced by combining HF resin with low loss fillers. The mechanical strength of the various RCC was characterized by a 90 degree peel test and measurement of tensile strength. RCC exhibited peel strength with Gould's JTC-treated Cu as high as 6 lbs/inch for halogen free RCC. These halogen free RCC materials exhibit coefficients of thermal expansion (CTE), ranging from 27 ppm/degC to 32- ppm/degC. Altogether, this is a new direction in the development of Green Packages and more specifically in the development of coreless substrates for semiconductor packaging. [C724]

### "Characterization and testing of novel polarized nanomaterial textiles for ultrasensitive wireless gas sensors"

A novel polarized nano-material (PNM) textile is fabricated and characterized at Ka-band (26.5 to 40 GHz) by rectangular waveguide measurements for three different polarization schemes (crossed, horizontal, and vertical polarized samples). Since carbon nanotubes were found to be ultra sensitive to different gases at extremely low concentration, a very important application is integrated gas sensors that are based on the change in the electrical properties of carbon nanotube materials induced by gas molecule adsorption. However, a systematic



design methodology for high frequency gas sensors utilizing carbon nanotube materials is not yet possible due to the lack of in-depth knowledge on the material properties before and after being exposed to the gases of interests. In this study, the scattering parameters of PNM textile embedded in waveguides are measured in both room atmosphere and in ammonia/air mixture of 5% ammonia. The gas measurement show a phase shift of 10 degrees in S11 values. The impedance of the PNMs are computed from the scattering parameters in waveguide measurements, which for the first time experimentally show that CNTs can function as resonators at microwave frequencies. [C725]

#### "Highly-reliable, 30µm pitch copper interconnects using nano-ACF/NCF"

Flip chip packaging of ultra fine pitch integrated circuits (ICs) on organic substrates aggravates the stress-strain concerns, requiring a fundamentally different system approach to interconnections, underfill, interfaces, and the substrate. This work demonstrates a novel interconnection solution with excellent reliability for ultra-fine pitch (~30 µm) silicon (Si) on organic first level interconnections by using copper (Cu) pillar with nano-anisotropic conductive film (nano-ACF)/non conductive Film (NCF). Novel nano-ACF/NCF materials were developed and evaluated for package level reliability criterion for mobile or portable electronics systems at ultra-fine first level interconnect pitch of 30 µm. Various additives were added to the formulation to enhance the reliability performance. Test vehicles (TVs) with 30 µm bump pitch were designed with 3 mm times 3 mm chip to extract both daisy chain resistance and single bump resistance data. As assembled bump resistivity was measured and the interconnect reliability performance was evaluated using the novel adhesive materials for flip-chip on organic packages. Performance of these test vehicles was studied for High Temperature Storage Life Test (HTS), Unbiased- Highly Accelerated Stress Test (U-HAST) and is currently being tested for Thermal Cycling Test (TCT). Test results showed that the interconnect resistance is better than or comparable to most common solders for both as assembled and U-HAST tested assemblies. The TVs depicted excellent reliability results in both HTS and U-HAST. Insulation resistance measurements showed that these adhesives are near perfect insulators and there is negligible difference in nano-ACF and NCF in terms of leakage current. On the basis of the results, nano-adhesive materials, proposed in this work provide unique opportunities for ultra fine pitch and high electrical performance interconnects. [C726]

#### "Micro-nano interconnect between gold bond pads and copper nano-wires embedded in a polymer template"

With the ongoing miniaturization and 3D integration trend in microelectronics packaging, a need exists to provide for denser chip interconnect than can be achieved with photolithography based processes. One way to achieve this is via a bumpless process using a S(ubmicron) W(ire) A(nisotropic) C(onductive) F(ilm) (SW-ACF) with a parallel array of submicron metal wires embedded in this film. This paper describes the first step of SW-ACF fabrication and bumped flip-chip bonding trials. The SW-ACF is based on a polycarbonate template filled with copper wires which is bonded onto a test chip with gold stud bumps. Electrical measurements showed that viable connections were made between the copper wires and the gold bond pads, and also that electrical insulation was maintained between bond pads. The concept worked for the smallest pad-pitch structure on the test chip which was 25 µm circular pads with 25 µm spacings. [C727]

#### "Non-contact magnetic actuation test technique to characterize interfacial fatigue fracture of thin films"

An innovative fixtureless test technique to study interfacial fatigue fracture in thin film stacks is proposed and implemented. Cyclic non-contact magnetic actuation is employed to supply the fatigue crack driving force along the interface between a released metal thin film cantilever and the supporting substrate. In-situ crack growth measurements with nanometer resolution are possible through electrical resistance monitoring of nano-scale metal traces that are located along the edge of the delaminating interface. Ti/Au nano metal traces are fabricated using electron-beam lithography and characterized to show stable electrical behavior. The fatigue test results were then used to assess the reliability of microcontact springs under fatigue loading for wafer probing applications. [C728]

#### "BCB with nano-filled BaSrTiO3 for thin film capacitors"

A BaSrTiO<sub>3</sub>-BCB composite was developed for spin-coating to integrate capacitors into multilayer wiring for Wafer Level Packaging (WLP) and System in Package (SiP). The size of nanoscale barium strontium titanate crystallite size was measured as 24 nm. The matrix for the composite was BCB with 63 wt.-% solids dissolved in mesitylene. Various dispersants were tested to find the best surfactant for the stabilization of BaSrTiO<sub>3</sub> in mesitylene, which is compatible with BCB. The optimum dispersant was used for preparation of suspensions with a solid loading of 20-35 wt.-% BaSrTiO<sub>3</sub> dispersed in mesitylene using 5.0-10 wt.-% dispersant. The resulting



average layer thickness of the cured composite is in the range of 1.7  $\mu\text{m}$ . These films can be easily integrated into existing thin film multilayer built-up wiring structures. The relative dielectric constant  $\epsilon_{\text{r}}$  of the investigated BaSrTiO<sub>3</sub>-BCB composite is 31. The breakdown voltage of the exceeds 170 V for 1.7  $\mu\text{m}$  thickness which equals a dielectric strength of 1.0 MV/cm. High reliability was proven for humidity storage (85degC and 85% rel. humidity, 2000 hrs) and thermal cycling from (AATC from -55degC to +125degC, 2000 cycles). [C729]

#### "Engineering nano interfacial layers for low contact resistance in chip to package interconnects"

This paper presents a study on the contact resistance of interconnects between chip and package of embedded chip technology. Multi-layered aluminum/titanium tungsten/copper interconnects (Al/TiW/Cu) were used as the model system. Design of experiment was carried out to characterize the effect of under bump metallurgy deposition steps, including the degas and radio frequency (RF) plasma etch steps, on contact resistance. A minimum level of degassing is needed, but the resistance was significantly affected by the amount of RF etch. Extensive failure analysis was done using focus ion beam (FIB), Auger electron spectroscopy (AES), scanning electron microscope (SEM), high resolution transmission electron microscope (HRTEM), and secondary ion mass spectroscopy (SIMS) to correlate the resistance to the quality of the bond pad surface and its interface with overlying TiW/Cu under bump metallurgy layers. With a carefully engineered solution, the contact resistance of aluminum/titanium tungsten/copper interconnects between chip and package was reduced almost 3 orders of magnitude to 10 milliohm range. FIB, SEM, AES, HRTEM, and SIMS were used to characterize the nano interfacial layers of both high contact resistance and low contact resistance samples. HRTEM showed the presence of a distinct interfacial layer between TiW and Al interface for both high and low resistance samples, which has not been reported before. The thickness and composition were characterized using SIMS and HRTEM. The macroscopic resistance characteristics were correlated to the state of the interface as established by SIMS and HRTEM. [C730]

#### "Design Simulation of Top ITO Gratings to Improve Light Transmission for Gallium Nitride LEDs"

We present simulation results of the indium tin oxide (ITO) top diffraction grating using a rigorous couple wave analysis (RCWA) for GaN LEDs. We study three different nano-structure patterns: cylindrical pillar grating, conical pillar grating, and cylindrical nano-hole grating. We show the light transmission improvement with nano-grating designs and present design-charts for the nano-hole grating. [C731]

#### "Nanostructuring technologies for reliable moveable elements"

Micro and nanosystems are the completed devices that combine into one sensor, electronic, and mechanical parts. Realization of the mechanical interaction between nano-, micro-, and macro world is the limiting factor for such a complex system. [C732]

#### "Influence of carbon, metal-coated polymer, and nano powders on sintering and electrical performance of nano-micro-filled conducting adhesives for z-axis interconnections"

This paper discusses micro-filled epoxy-based conducting adhesives modified with nanoparticles, carbon, and metal-coated polymer fillers for z-axis interconnections. A variety of conducting adhesives with particle sizes ranging from 5 nm to 15  $\mu\text{m}$  were incorporated as interconnects in printed wiring board (PWB) or laminate chip carrier (LCC) substrates. Scanning electron microscopy (SEM) and optical microscopy were used to investigate the micro-structure, and conducting and sintering mechanisms. Sheet resistance of Ag, carbon, and metal-coated polymer filler was low. Among all, metal-coated polymer showed the highest resistance. Sheet resistance decreased with increasing curing temperature. Drop in resistance for carbon-doped samples was 90% from 200degC to 275degC. It was found that with increasing curing temperature, the resistance of the conducting paste decreased due to sintering of metal particles. Sintering temperature and corresponding grain growth of nano-micro adhesive was further evaluated using different size nano particles, and shows optimum sintering at 240degC. Adhesives formulated with highly filled silver nano-micro particles exhibited a Z-axis coefficient of thermal expansion (CTE) of 17 ppm/degC, and as high as 41 ppm/degC for carbon doped, highly filled silver nano-micro systems. Similarly, Z-CTE of highly filled metal-coated polymer fillers was 28 ppm/degC. As a case study, a variety of z-axis interconnect constructions for a flip-chip plastic ball grid array package, as well as for PWB were fabricated and evaluated at both the subcomposite and composite levels to understand and reduce paste-to-package CTE mismatch. Several conductive adhesives were used in the z-axis interconnect constructions for LCC and PWB. The present process allows fabrication of z-interconnect conductive joints having diameters in the range of 55 to 300  $\mu\text{m}$ . The processes and materials used to achieve smaller feature dimensions, satisfy stringent registration requirements, and achieve robust electrical interconnections are discussed. [C733]



### "Thermal conductivity of epoxy/surface functionalized carbon nano materials"

Multiwalled carbon nanotubes (MWCNTs) and graphite nanoplates were functionalized by chemical methods. The functionalized chemical structures were characterized by Fourier-Transform Infrared (FTIR). It is found that carboxyl groups were grafted onto MWCNTs and graphite nanoplates surfaces. Epoxy and cyanate ester polymer composites with functionalized MWCNTs and graphite nano plates were prepared, and their thermal conductivities were measured by the a Netzsch Nano Flash, which showed that the thermal conductivity of the polymer composites can be significantly improved by building chemical bondings between polymer matrix and carbon nano fillers. [C734]

### "Mechanical characterization of ultra-thin films by combining AFM nanoindentation tests and peridynamic simulations"

In this study, the loading-unloading data obtained from the nono-indentation tests in combination with the peridynamic simulations are used to determine the elastic modulus and yield stress of the material. A simple search algorithm minimizing the difference between the predicted force- indentation depth and experiments leads to the determination of the material properties. Nano-indentation experiments are performed on both a soft polymer (polymethylsiloxane (PDMS)) representative of the bulk dimensions, and a hard thin-film polymer (polystyrene (PS)) deposited on the bulk PDMS. Both the simulation and experimental results are validated by comparison against those previously published in the literature. [C735]

### "Lateral compliance and elastic stability of a dual-coated optical fiber of finite length, with application to nano-rods embedded into low-modulus elastic media"

We address the lateral compliance and elastic stability of a dual-coated fiber of finite length (such as, e.g., an optical fiber interconnect) and apply the obtained solution to a nano-rod (nano-wire, nano-fiber, carbon nano-tube) embedded into a low-modulus elastic medium. The latter situation is encountered in nano-composites, as well as in some advanced heat-spreaders employing nano-rod-arrays. Both the photonic (dual-coated fiber) and the nanotechnology (nano-rod embedded into an elastic medium) related problems can be reduced, as far as modeling is concerned, to the problem of the mechanical behavior of a cantilever (in the case of an optical fiber) or a "free-free" beam lying on a continuous elastic foundation and subjected to the combined action of axial compression and lateral loading or to the elevated axial loading. We develop physically meaningful analytical "mathematical" models that enable one to predict the behavior of the structural elements in question. Our models enable one to determine the appropriate length of the fiber (rod), establish the condition of its elastic stability, select the coating materials or the embedding elastic medium with the most favorable properties, establish the adequate thickness of the primary coating or the level of the contact pressure, etc. [C736]

### "A coaxial probe system for measuring Z-direction electrical resistivity of conductive polymers"

A novel coaxial Kelvin probe technique has been developed to measure the z-axis electrical resistivity of conductive polymer adhesives. The approach uses a very simple test structure, comprising of a sandwich of the conductive adhesive material between two Copper conductors. The coaxial probe includes an outer region through which the current is forced, and an inner probe which senses the surface voltage drop, and is hooked to a nano-voltmeter to enable micro-ohms resistance measurements with high sensitivity. This is followed by detailed finite element modeling of the sample and probe set-up configuration to extract an accurate value for the effective z-axis resistivity of the conductive adhesive, as well as its bulk and interfacial z-resistivity values. This technique has been demonstrated on two candidate conductive materials as well as solder (as a reference). It has the potential to enable rapid optimization and development of conductive polymer adhesive systems for different interfaces and for various applications. [C737]

### "Bridging technology-CAD and design-CAD for variability aware Nano-CMOS circuits"

Transistor variability has emerged as one of the important constraints in Nano-CMOS circuit design. The ever decreasing device feature size with CMOS scaling, has resulted in an increasing uncertainty in predicting the exact device behaviour. The issue of variability needs to be addressed across the entire hierarchy of integrated circuits-optimization of process and device technology to yield minimal variability, robust circuit and system design architectures for variability aware design, and CAD tools to unify these two domains. The traditional variability modeling and CAD techniques address the problem in one of the two domains. We propose a unified framework to bridge the gap between technology CAD and design CAD. This framework enables one to directly relate the variation in circuit metrics such as speed, static power and dynamic power to the underlying semiconductor process parameters such as implant dose, annealing temperature etc. The proposed methodology



is validated through rigorous simulations at the process, device and circuit level, incorporating various statistical techniques. A few examples will be presented to elaborate the significance of the proposed modeling methodology and its utility in the Nano CMOS design flow. In addition to being an important utility in the circuit design flow, the methodology will also help the foundries by providing a visibility on the impact of unit processes on the eventual circuit characteristics. This in turn can help in a systematic and optimized process monitoring in the foundries. [C738]

#### **"Nanopower sampled data wavelet filter design using Switched Gain Cell technique"**

In order to realize a nano-power wavelet filter for biomedical applications, this paper applies the singular value decomposition approximation to transform the time domain 1st-derivative of a Gaussian (gauss1) wavelet base into a 5th-order z-domain transfer function. Consequently, to realize the approximated transfer function in CMOS technology employing circuitry that operates from a low supply voltage, a sampled data circuit technique, coined dasiaswitched gain cell, (SGC),psila is introduced. Using the SGC technique, standard MOS switches, simple subthreshold (nonlinear) transconductors and their associated parasitic capacitances suffice to constitute the filter, while the scale of the filter can be controlled by the clock frequency. This renders the filter architecture to be simple, modular, and area efficient. Simulation results, using 0.13  $\mu\text{m}$  CMOS model parameters, show that the wavelet filter implements the gauss1 wavelet base well, operates from a 1 V supply and consumes less than 0.47  $\mu\text{W}$  quiescent power. [C739]

#### **"Soft-Error Hardening Designs of Nanoscale CMOS Latches"**

As technology scales down in the deep sub-micron/nano ranges, CMOS circuits are more sensitive to externally induced phenomena to likely cause the occurrence of so-called soft errors. Therefore, the operation of these circuits to tolerate soft errors is a strict requirement in today's designs. Traditional error tolerant methods result in significant cost penalties in terms of power, area and performance, and the development of low-cost hardened designs for storage cells (such as latches and memories) is of increasing importance. This paper proposes new hardened designs for CMOS latches at 32 nm feature size. Three hardened latch circuits are proposed; two of these circuits are Schmitt trigger based, while the third one utilizes a cascode configuration in the feedback loop. These new hardened latches are shown to have superior performance in terms of power-delay product as well as highest tolerance to soft errors (measured by the critical charge) than existing hardened latches. Extensive simulation results are provided using the predictive technology file for 32 nm feature size in CMOS. [C740]

#### **"FPGA implementation of a video-rate fluorescence lifetime imaging system with a 32x32 CMOS single-photon avalanche diode array"**

A new integration based fluorescence lifetime imaging microscopy (FLIM) called IEM has been proposed to implement lifetime calculations. A real-time hardware implementation of this IEM FLIM algorithm suitable for a single photon avalanche diode (SPAD) array in 0.13  $\mu\text{m}$  CMOS technology is now implemented on FPGA. A widefield microscope was adapted to accommodate the array and test it on biological applications. Video-rate fluorescence lifetime imaging has been achieved, by performing parallel 32x32 lifetime calculations, realizing the first, compact, and low-cost FLIM camera. [C741]

#### **"Nanotechnology environmental, health, and safety issues: brief literature review since 2000"**

Despite the many touted benefits of nanotechnology, growing concerns exist regarding the potential environmental, health, and safety (EHS) risks associated with nanomaterials. The number of published research papers in this area has grown significantly in recent years, mostly focused on nanotoxicology. Characterizing the current scientific literature is important for understanding the diversity of efforts over a range of fields. This article presents a brief review of nano-EHS literature published since 2000 with particular emphasis on non-toxicological risk analysis trends, although the number of such studies is limited compared to toxicological studies. Understanding these trends can provide important insights to scientists, engineers, and regulators. [C742]

#### **"Noiseless and vibration-free Ionic Propulsion technology for indoor surveillance blimps"**

We present in this paper a novel indoor blimp that is propelled by a propulsion technology that uses no moving mechanical parts and thus is noiseless and vibration free. In our prior work reported at IEEE/ASME AIM 2007, we demonstrated several prototype propulsive units (with asymmetric capacitor configurations) that lift themselves into air. Using these basic propulsive units ("Ionic Flyers"), we have recently developed an indoor flying blimp that has a propulsion system with no moving mechanical parts and thus generates no noise or vibration-the Ionic Propulsion Blimp. The key to successfully create this novel indoor flying system is the development of a power generation system that includes an 11.1V battery which is capable of generating 20kV



DC voltage continuously over time for a load in the MΩ range. The architecture of this ionic power system will be presented. A detailed parametric analysis and an optimal design methodology of the Ionic Flyer are also discussed. Initial experimental results of the Ionic Propulsion Blimp are also summarized in this paper. [C743]

#### "Optimizing HPC and parallelization for computation Nanotechnology in MCCS environment"

The essence of High performance computing (HPC) in the field of Nanotechnology and problems encountered by HPC arrangement in applying HPC to Nano-enabled calculations have been presented in the paper. A proposal to optimize computations in an HPC setup and distribution of work in various clusters has been formulated to make Nanotechnology computations more effective and realistic on a Windows Cluster Server based framework. Results and findings in the expected setup and the computation complexities that will be needed in its implementation have been suggested with an algorithm to take advantage of inbuilt powerful parallelization and distribution capabilities of Windows Server 2003 Compute Cluster Edition making large scale simulation possible. Connection of four nodes with the help of Microsoft Compute Cluster Server 2003 (MCCS 2003) has been carried out and algorithms were constructed in C# using Visual Studio IDE. In addition to the .NET Framework, Extreme Optimization Numerical Library for .NET has been used for performing high speed mathematical calculations. MPI .NET library has been employed to build parallel algorithms and breaking of computations into small tasks. Microsoft's implementation of Message Passing Interface (MPI) included in MCCS was used for running computation application tests. Implementation of HPC in measuring reliability of Nanotechnology-based devices and computations of certain complex techniques in Nanotechnology is presented with a significant improvement in performance as compared to the last work which was implemented using distributive computing toolbox in MATLAB. Besides its use in large-scale computations, C# also offers more control over programming, runtime and execution of the application. A description of the progress in this area of research, future works and an extended approach in the same field is shown. [C744]

#### "Defect-aware logic mapping for nanowire-based programmable logic arrays via satisfiability"

Programmable logic arrays (PLAs) using self-assembly nanowire crossbars have shown promising potential for future nano-scale circuit design. However, due to the density and size factors of nanowires and molecular switches, the fabrication fault densities are much higher than those of the conventional silicon technology, and hence pose greater design challenges. In this paper, we propose a novel defect-aware logic mapping framework via Boolean satisfiability (SAT). Compared with the prior works, our technique considers PLA defects on both input and output planes at the same time. This synergistic approach can help solve logic mapping problems with higher defect rates. The proposed method is universally suitable for various nanoscale PLAs, including AND/OR, NOR/NOR structures, etc. The experimental results have shown that it can efficiently solve large mapping problems at a total defect rate of 20% or even higher. We further investigate the impact of different defects on PLA mapping, which helps set up an initial contribution for yield estimation and utilization of partially-defective PLAs. [C745]

#### "Advanced BEOL integration using porous low-k ( $k=2.25$ ) material with charge damage-less electron beam cure technique"

As a practical curing technique of low-k material for 32-nm BEOL technology node, we demonstrated that electron beam (e-beam) irradiation was effective to improve film properties of nano-clustering silica (NCS). We confirmed that by using optimized e-beam cure condition, NCS was successfully hardened without degradation of dielectric constant and the Young's modulus increased by 1.7 times compared with that of thermally cured NCS. We fabricated two-level Cu wirings layers with NCS cured by optimized e-beam cure technique. The e-beam cure dramatically enhanced the lifetime of time-dependent dielectric breakdown (TDDB) of interlayer dielectrics. We also examined the influence of the charge damage to the MOSFETs under e-beam cured NCS layer and confirmed that there was no e-beam charge damage to the Ion-Ioff characteristics and reliability of MOSFETs with the optimized e-beam cure. [C746]

#### "Metrology of 3D IC with X-ray Microscopy and nano-scale X-ray CT"

Metrology of 3D integrated circuits (IC) have presented new challenges to existing metrology technologies, particularly in cases where the 3D structure of the sample must be measured non-destructively. X-ray microscopy, on the other hand, offers very deep penetration and better than 50 nm resolution, as well as ability to distinguish different elemental compositions. When combined with computed tomography (CT) technology, the full 3D structure of an IC can be obtained non-destructively at tens of nanometer accuracy, thus making x-ray nano-CT well suited for both metrology and failure analysis (FA) applications with 3D IC. [C747]

#### "New multi-step UV curing process for porogen-based porous SiOC"



In order to control the characteristics of porogen-based porous SiOC film ( $k < 2.5$ ), we investigated its dependence on the wavelengths of ultraviolet (UV) light by using methods of FT-IR, TDS and nano-indentation. As a result, it was found that specific wavelengths of UV light strongly was effective to porous SiOC film production: porogen desorption, mechanical strength improvement, and reduction of the film damage. Vacuum ultraviolet (VUV) irradiation is necessary for porogen desorption. However, after porogen was removed from SiOC film, the energy of VUV irradiation was too high for porous SiOC film and this caused film damage. The energy of deep ultraviolet (DUV) irradiation was sufficient to improve mechanical strength. We propose that UV curing process should be a multi-step process consisting of VUV and DUV irradiation. The first step removes porogen using VUV irradiation. The second step forms robust porous SiOC film using DUV irradiation. A multi-step curing process was used to control the characteristics of porogen-based porous SiOC film. [C748]

### ""Keeping up with Bioinformatics and Computational Biology as applied to biomedicine-Where has it been? Where is it going?""

Bioinformatics as it applied to medicine has changed over the years from its origins in sequence analysis and data management. It has moved from its computer science roots to interdisciplinary applications. Iterative modeling, analysis, and re-synthesis driven by data and information integration and fed by next-generation high through-put measurement technologies as inputs, and carefully applied to driving biological problems, is the new way forward. In addition, we now know that the field is interdisciplinary and also translational. At its core, the new bioinformatics, now called systems biology, is conceived of as a set of multi-scale theories enabled by integration of tightly-coupled datasets ranging from the genome, to transcriptome, to epigenome, to micro- and si-RNAs, to the proteome, to the lipome and metabolome. When this nested hierarchy crosses from the cell level to the tissue, organ, and begin to interact with one another, computational biology approaches begin to dominate and a new field of computational human (or organismal) systems biology emerges. These macroscopic levels are informed by the biologic elements of developmental state, physiology, and structural/functional relationships; similarities exist at the at the micro- (cellular systems biology) and nano- (bioinformatics) levels. The overarching problem at all scales is how we handle the enormous complexity in these multidimensional systems. To address this issue, an important new thrust in bioinformatics and computational biology involves appropriately reducing apparent complexity in the system one is studying by the application of modeling and network theory analytics and methods. Interestingly, striking a balance between reductionist and synthetic approaches are likely most appropriate to gain new insights. Extending these methods to populations and communities, from metagenomics to large-scale clinical trials, bring probability and statistics to the forefront-both Frequentist and Bayesian. Additionally, working with human participants in clinical studies and trials has spawned a whole new field of clinical and translation informatics and Information Technology (IT) integration. In addition, the talk will give status updates and set up discussion(s) related to the following topics: The Virtual Physiological Human-the ongoing saga; Lessons from the Clinical and Translational Sciences Awards (CTSA): How is informatics transforming academic health centers? Where are the bottlenecks? Can biomedicine use Petascale computing?-Ideas we should discuss; The other Petascale issue we face-data deluge; Personal ruminations on NIH Roadmap #2, and the central role of computational science methods and infrastructures; Lessons beyond biomedicine to applications of DoE interest: Where are the synergies and points of leverage with NIH? [C749]

### "Reconfigurable circuit design with nanomaterials"

It is generally acknowledged that nanoelectronics will eventually replace traditional silicon CMOS in high-performance integrated circuits. To that end, considerable investments are being made in the research and development of new nanoelectronic devices and fabrication techniques. When these technologies mature, they can be used to create the next generation of electronic systems. Given the intrinsic properties of nanomaterials, such systems are likely to deviate considerably from their predecessors. In this paper, we compare two potential architectures for the design of nanoelectronic FPGAs. By evaluating the performance of nanoelectronic devices at the systems level, we aim to provide insights into how they can be used effectively. [C750]

### "Nano-electronics challenge chip designers meet real nano-electronics in 2010s?"

It is vital for nano-electronics to undertake an immediate action in order to catch up with what was lost in the past 10 years. For that purpose, co-design by designers and technologists is essential. This is because very short term development of these nano-electronics is needed for this situation. In co-design for nano-electronics, designers have to have plural candidates of devices for their new applications and clarify the requirements for the devices even in early stages. The purpose of this paper is to give opportunities to learn three practical case-studies discussing (1) power saving; (2) performance vs. process variation; and (3) new architecture using emerging nanodevices. They will be presented on how designers and technologists can collaborate to resolve the challenges of post-silicon devices. [C751]



### "Nano-biophotonics: From laboratory research to biomedical diagnostics"

This lecture presents an overview of recent advances in the development of nano-biophotonic technologies including nanosensors and nanoprobe at the nexus of biology, medicine and nanotechnology. This presentation describes two areas of research related to the development of nanoprobe and nanosensors for single-cell analysis and imaging: (1) plasmonics molecular sentinel nanoprobe using surface-enhanced Raman scattering (SERS) detection, and (2) nanosensors for in vivo analysis of a single cell for molecular diagnostics and imaging, and ultra-high throughput screening. [C752]

### "Future prospects for smart sensor systems"

The generic term "smart sensor" addresses several aspects including miniaturization, sensor communication and flexible integration in higher-level systems. It involves the use of signal processing able to eliminate influencing effects and extract high quality sensory information in order to realize a robust signal transmission. In this contribution, we will give an overview about the history of the term "smart sensor" since its release in the 70s and categorize the main aspects involved with this term as a basis for the prognosis of future trends. In the second part of the paper we provide some up-to-date examples and future trends for important developments in this field including "energy harvesting", "varied input sensor" and novel sensors based on nanotechnology. [C753]

### "Semi-autonomous scheme for pushing micro-objects"

In many microassembly applications, it is often desirable to position and orient polygonal micro-objects lying on a planar surface. Pushing micro-objects using point contact provides more flexibility and less complexity compared to pick and place operation. Due to the fact that in micro-world surface forces are much more dominant than inertial forces and these forces are distributed unevenly, pushing through the center of mass of the micro-object will not yield a pure translational motion. In order to translate a micro-object, the line of pushing should pass through the center of friction. In this paper, a semi-autonomous scheme based on hybrid vision/force feedback is proposed to push microobjects with human assistance using a custom built tele-micromanipulation setup to achieve pure translational motion. The pushing operation is divided into two concurrent processes: In one process human operator who acts as an impedance controller alters the velocity of the pusher while in contact with the micro-object through scaled bilateral teleoperation with force feedback. In the other process, the desired line of pushing for the micro-object is determined continuously using visual feedback procedures so that it always passes through the varying center of friction. Experimental results are demonstrated to prove nano-Newton range force sensing, scaled bilateral teleoperation with force feedback and pushing microobjects. [C754]

### "Crack and damage evaluation in low-k BEoL stacks under chip package interaction aspects"

The electronic industry drive for miniaturization and increasing functional integration forces the development of feature sizes down to the nanometer range. Moreover, harsh environmental conditions and new porous or nanoparticle filled materials introduced on both chip and package level-low-k and ultra low-k ILD materials in back-end of line (BEoL) layers of advanced CMOS technologies, in particular-cause new challenges for reliability analysis and prediction. The authors show a combined numerical/experimental way and results towards optimized fracture resistance of those structures under chip package interaction aspects utilizing integral bulk and interface fracture concepts, VCCT and cohesive zone models in multi-scale and multi-failure modeling approaches with several kinds of imperfections. As important preconditions for high-quality simulations, nano-indentation AFM, FIB and EBSD provide the desired properties, while FIB-based trench techniques using deformation analyses by grayscale correlation and numerical simulations provide the intrinsic stresses especially of thin films in BEoL layers. [C755]

### "Smart systems integration by using micro- and nanotechnologies"

The micro and nano system technologies as well as electronics are playing a key role in today's product development and industrial progress. They enable the integration of mechanical, electrical, optical, chemical, biological and other functions into a very small space with dimensions ranging from sub micrometers up to some millimeters. Combined with intelligence, power supply and communication ability, these systems are multi device integrated and should be developed for use inside the host. Systems integration will determine the economic success of manufacturers and users coming mostly from consumer electronics, telecommunication, mechanical engineering, medical technology, and automotive. To ensure long-term competitiveness a sophisticated technological potential is necessary. The Fraunhofer ENAS (till June 30th 2008 Branch Chemnitz of Fraunhofer IZM) is positioning itself to meet these challenges and participates very actively in the further development of smart systems integration and the required bridging of the gap from NANO to MICRO and to the MACRO world.



[C756]

### "F1: SSD memory subsystem innovation"

Solid-state disks (SSDs) and emerging memories such as fusion memories, PCRAM, FeRAM, and MRAM have enabled innovations in various nano-scale VLSI memory systems for personal computers, multimedia applications, and enterprise servers. The full-day Forum is intended to provide a comprehensive review of various state-of-the-art memory architectures, as well as memory technologies. [C757]

### "A release-on-demand wireless CMOS drug delivery SoC based on electrothermal activation technique"

Recently, micro- and nano-technologies have enabled rapid progress in biomedical applications. Although in vitro analytical and diagnostic tools have been the focus of such technologies, in vivo therapeutic and sensing applications have received significant attention in the past few years. Novel implantable drug delivery devices, which can precisely control key therapy parameters, have the potential to increase the efficacy of drug therapy. This paper presents an implantable CMOS drug delivery SoC, in which a wireless controller/actuation circuitry and a drug delivery array are monolithically integrated. Compared with current technologies, the advantages of the proposed device include lower system cost, smaller device size and lower power consumption. This device can be implanted by minimally invasive surgery and is suitable for the localized diagnosis/therapy of cancers, or the immediate treatment of unpredictable heart attacks by releasing drugs such as nonapeptide leuprolide acetate or nitroglycerin. Physicians can also make non-invasive therapy modification by using the wireless capability. [C758]

### "SEU Effects on QCA Circuits"

Quantum cellular automata (QCA) represents an emerging technology at the nano technology level. Nowadays, many applications and design methods of QCA technology are introduced. Defect tolerant design of QCA circuits is a challenging case. Here, we will investigate the effects of single event upsets (SEU) on QCA circuits and the defects which may occur. [C759]

### "Thermo-mechanical reliability assessment for 3D through-Si stacking"

The through silicon interconnection technology for stacked dies is a promising way of future package construction as it lowers yield risks of large die sizes and allows cost effective packaging solutions for heterogeneous electronic systems. Thermo-mechanical reliability dependent on processing and mounting steps as well as during testing are one major concern, which was addressed by FEA. The numerical investigations addressed single through-Si vias of different sizes and geometrical features, effects of multiple vias and those of mounting through-silicon stacked dies in plastic packages. It is shown that appropriate modeling requires the inclusion of multiple high temperature process steps as well as non-linear material properties for miniaturized materials used, realized by submodeling and sequential build-up techniques. A computational time consuming 40 steps calculation scheme was selected to include intrinsic stress from processing in the final package under thermal cyclic loading. Thin film elastic-plastic behavior of metals, in particular of the Cu-via, was accounted for as measured by nano-indentation while polymeric materials were treated viscoelastically based on tensile measurements of miniaturized specimens. [C760]

### "Table of contents"

The following topics are dealt with: small antennas; portable device antennas; mmWave antennas; THz antennas; nano antennas; metamaterial; MIMO antennas; beamforming antennas; antennas measurement; and UWB antennas. [C761]

### "Three-dimensional multi-modal microscopy"

Advances in lasers in recent decades have led to novel techniques of microscopy that are only possible with powerful coherent sources. Modern electronic cameras and computers have made it possible to capture, process, and display the resulting images. The continued growth in computing power now makes it possible to combine images from different microscopic imaging modalities. The W. M. Keck Three-Dimensional Fusion Microscope brings together multiple modes of microscopy on a single platform, with the ability to switch from one to another rapidly without moving the specimen. With this microscope, it is possible to examine the spatial relationships among components of the specimen each of which is visualized with a different mode, to use one mode as validation for another, and to combine multiple modes to exact information that would not be available from any single mode alone. In addition to the commonly used modes of brightfield, differential interference, epi-



fluorescence, this instrument has confocal and multi-photon fluorescence, second-harmonic, frequency-agile confocal reflectance, fluorescence recovery after photo-bleaching, and optical quadrature microscopy. The last of these is used for full-field quantitative phase imaging. The initial applications of the microscope are in the imaging of embryos, skin, and nano-fabricated structures. Sample results will be shown, and the design issues that arise in the combination of multiple modalities will be discussed. [C762]

#### **"Suppression of DIBL in deca-nano SOI MOSFETs by controlling permittivity and thickness of BOX layers"**

The Metal-Oxide-Semiconductor Field-Effect-Transistor (MOSFET) fabricated on a Silicon-On-Insulator (SOI) substrate is effective to suppress Short Channel Effect (SCE), and is one of the most promising electron devices for Very Large Scale Integration (VLSI) circuits for higher speed, higher integration density, and lower power consumption, and it has been already demonstrated that SCE in deep submicron SOI MOSFETs comes from Drain-Induced Barrier Lowering (DIBL) at SOI/Buried OXide (BOX) interface by the author's group. This paper elucidates the roles of permittivity and thickness of BOX layers in suppressing the DIBL in SOI MOSFETs by performing numerical device simulations of SOI MOSFETs with various permittivity and thickness of BOX systematically and by visualizing distribution of dielectric flux lines and current flow lines as well as contour potential lines in MOSFETs. [C763]

#### **"Nanofiltration and Ion-Exchange Alkalinization for Water Conservation and Zerodischarge in Circulating Cooling Water System"**

Pipe corrosion, scaling and microbial growth in the circulating cooling water system cause many problems which threat the stable and safe operation of power plants. In order to solve these problems in circulating cooling water system, this paper puts forward an innovative method, nano-filtration and ion-exchange alkalinization technology, for water conservation and zero-discharge and describes the principle and practice of this technology to ensure that the concentration factor of circulating cooling water can reach up to 10. [C764]

#### **"Quantum compact model for ballistic double gate MOSFETs"**

A proposed compact model including quantum confinement and drain induced barrier lowering (DIBL) based on the calculation of charge and injection velocity is presented. The model used a single expression for current calculation in all regions to ensure the continuity of the model over all regions of operation. The model succeeded to simulate the ballistic double gate (DG) nano MOSFETs from linear to saturation regions of operation. The validation of the model was done by comparison with the standard NANOMOS numerical simulation. The error in the saturation region is about 6% and does not exceed 10% in the linear region. [C765]

#### **"Nano-motion stage for high speed and precision positioning on an X-Y plane"**

Precision positioning technology with high speed on an X-Y plane requires to a manufacturing inspection for semiconductor and flat display areas, and so on. The authors proposed a new actuator called "Nano-Motion Actuator (NMA)" for track following on a spin-stand that evaluated magnetic heads and media for high density magnetic recording. We applied technologies of the NMA to a new actuator mechanism that has two degrees of freedom. The actuator could position on the X-Y plane with micrometer resolution. [C766]

#### **"Active components embedded into organic boards-Accelerated design by means of finite element simulation and micro deformation measurements"**

More and more dense packaging is one of the most important challenges in advanced electronics and micro technology. One way to achieve this is to bury active as well as passive components into the printed circuit boards. In addition, very short interconnects can be realised which is advantageous especially for RF applications. Besides the pure functionality, the designers of new products have to meet reliability requirements. This is not only related to the electrical properties but also to the thermal as well as the thermo-mechanical design. As most as possible of the imaginable loading conditions have to be investigated which are expected during manufacturing, testing, storing, and operation. This can be done efficiently by numerical studies based on finite element analyses (FEA), accompanied by deformation measurements at suitable test structures. The resulting methodology is outlined here, can be generalised, and applied to many design procedures before any real parts are available. It is helpful to reduce cost and time-to-market for future products by minimising real tests and an expensive redesign. [C767]

#### **"An electrically driven quasi-L2 photonic crystal nano-cavity with a small mode volume"**

In recent years, the theories and technologies of optically pump photonic crystal (PC) devices, such as PC lasers



and single photon sources, have been investigated extensively. However, progress on electrically driven PC devices has not been as successful. In 2004, Park et al. demonstrate an electrically driven PC laser, which has a sub-micrometer semiconductor post at the center of the single cell PC cavity [1]. The central post acts as an electrical conduction channel as well as a heat sinker nicely. On the other hand, to achieve efficient PC devices, such as lasers and single photon sources, PC cavities with not only high Q values but also small mode-volumes ( $V_m$ ) are necessary. Among the reported PC cavities, L3 cavity, modified-H1 cavity, and quasi-L2 (qL2) cavity are good candidates for realizing high efficiency PC devices [2~4]. Both the L3 and modified-H1 cavities provide a central mode with very high Q values while the qL2 cavity has a dipole mode with an extremely small mode-volume ( $\sim 0.019 \mu m^3$ ) at the central region. Therefore, the characteristics of the aforementioned PC cavities would suffer from the presence of the central post in terms of mode confinement and integrity. In this work, we propose an oxygen-ion implantation method to replace the central post. An electrically driven InAs quantum dot (QDs) light-emitting diode with qL2 PC cavity is demonstrated. [C768]

### "Exploring the potential of microarray technology for bio/nano sensing"

Microarray is one of the most powerful DNA detection systems with multiplexing and high throughput capability. However, the current application of microarray is limited to the preliminary genomic screening of biological samples despite of its excellent potentials for other applications, such as biosensing. This paper addresses microarray's possibilities as sensing device by investigating its limit of detection (LOD) and limit of quantification (LOQ), which are defined as the minimum fluorophore concentration for the liable signal detection. The LOD and LOQ, i.e., detection sensitivity, are key indexes to determine the microarray's applicability as bio/nano sensing device. [C769]

### "MEMS-based multi-sensor integrated attitude estimation technology for MAV applications"

In this paper we proposed an integrated attitude estimation Kalman filtering technology based on the MEMS sensors for the guidance and navigation of MAV. In the designing of algorithm, the outputs of accelerometer were compensated by airspeed meter, then the gravitational and geomagnetic field vectors were used to correct the attitude solved from gyroscopes through a fifteen-state Extended Kalman Filter. The measurement values of Kalman filter were calculated from the attitude errors obtained through introducing the magnetic yaw and horizontal attitude. Furthermore, the stochastic errors of the gyroscope and accelerometer were set into state vector, which could correct the outputs of the inertial sensors and improve the measurement accuracy. The foremost advantage with presented approach was that the state equations and measurement equations were linear which making it easily to implement. The simulation of dynamic flight tests demonstrated that the estimated error of yaw, pitch and roll less than 1.0deg, 1.2deg and 0.5deg respectively. It also proved the presented Kalman filter could improve the accuracy of attitude estimation effectively. [C770]

### "Design and analysis of helical flagella propelled nanorobots"

Advancement in the field of nanorobotics has been facilitated by the current advances in nano-bio-technology and nanofabrication methods. The important uses of nanorobots are in advancing medical technology, healthcare and environment monitoring. In bio-medical applications, nanorobots need to swim in biological fluids flowing in narrow channels of few hundred nanometer size. The dominating effects in nanometer size domains are increased apparent viscosity and which makes the design of a propulsion mechanism a challenging task. Micro and nano size biological organisms move by generating planar waves or rotating helical flagella. In the present work, design of propulsion with helical flagella is proposed and a generalized analytical model is developed, simulated and discussed. The performance parameters of the developed model viz. velocity and efficiency have been computed based on resistive force theory and compared with those of the model available in literature. Improved performance, feasibility and generality of the developed flagellar model have been discussed. [C771]

### "Plenary lecture 3: "Recent progress in developments of single-nano diamond particles""

After 45 years of unfortunate delay, nanodiamond particles having  $4.8 \pm 0.7$  nm in diameter are now emerging as one of the most promising candidates for a general purpose material in nanotechnology for the reasons of (1) low cost, (2) non-toxicity, (3) high crystallinity, and (4) versatile maneuverability. (1) The raw material is a TNT-based war explosive, once most popular, over-produced but now becoming out-of-date. (2) Complete absence of cytotoxicity for a variety of cell types has been proved by the work of Dai/Schrand. (3) 'Diamond is forever.' (4) Single-nano diamond particles are soluble in water and a few organic solvents to give transparent and stable colloidal solution, hence can be derivatized by homogeneous reaction. Crude agglutinates of detonation nanodiamond have been produced in the past decade on the scale of few tons a year but last year test production of dispersed SND began in Japan. [C772]



### "CNT-based extreme low-power micro motion sensors"

Based on DEP manipulation of CNTs, our group has, in the past few years, systematically developed a time-efficient approach to engineer CNT based sensors, i.e., only 1sec is required per CNT sensing element. Some examples of CNT devices fabricated with this technology includes MEMS pressure sensors, chemical sensors, and flow shear stress sensors. In this talk, we will focus our discussion on the development of CNT-based inclination and acceleration sensors for motion detection. The most important factor for investigating CNTs as next generation sensing elements is that they may provide 1000 times of reduction in activation power (i.e.,  $\mu\text{W}$  range) requirement than conventional MEMS sensors. [C773]

### "Keynote lecture 3: "MEMS as tools for nanotechnology""

In Nanoscience, individual, nanometer size objects are prepared to create a specific functionality, which shall then be investigated. The interaction with the object during the preparation or investigation has to be focused to a very small location. This can be achieved by either using very specific, chemical reactions, which can "tackle" the object in only one way, like in labeling proteins with a specific fluorophor e.g. in immuno essays. Similarly, focused electron or ion beams can be employed to probe the object, or a very elegant way is to use "mechanical foci" to spatially limit the interaction. In the later implementation tipped probes measure e.g. forces, temperature, or conductivity to mention just a few. Another successfully applied mechanical constriction is the nano-pore. This very simple sensor opens the door to label-free, single molecule detection. [C774]

### "Plenary lecture 5: "Bio-medical micro-nano robotics""

Bio-medical engineering attracts lots of attention in an aged society. Especially, micro-nano robotics plays an important role to supply advanced devices and equipments. For example, there is an increasing interest in miniaturization and integration of medical devices by MEMS/NEMS technologies. Recent progress enables us to build manipulators and mobile robots which can work in the body. For minimally invasive surgery, micro-nano robotic technology is indispensable. In the area of tissue engineering, micro-nano fabrication is essential to research cell morphology. Micro-nano fabrication technology is applied to fabricate scaffolds for tissue engineering[1] and to build medical human simulator. Another interest is in manipulation technology for works from millimeter to nanometer scale. In the area of livestock industry, cloning works will be made more efficient by on-chip manipulation of egg cells and donor cells[2]. By controlling local environment around the cell, we actively lead to chemical/physical interaction inside and outside the cell, and measure changes[3]-[5]. These works will contribute to elucidate the mechanism of the cell system, realize gene expression control, and regenerate tissue by function control with mechanical stimuli. Interdisciplinary research works between engineering, biological and medical fields are promoted. This talk will provide the state of the art of micro-nano robotics in biomedical field. New trends and future aspects will be addressed. [C775]

### "Two new micro programmable gratings and their potential applications"

This paper presents the basic concepts of design and fabrication for two new micro programmable gratings, and gives preliminary research results for demonstrating their potential applications. Firstly, a surface-micromachined micro programable grating with its blazed angle electrostatically modulated was described. To maximize the blazed angle, dimples were taken as key components for the grating beams and their depth was specially designed to close to the air gap. After fabrication, the realized maximum blazed angle can reach 5.1deg. Then, the micro programmable blazed grating was applied for multispectral imaging and the initial results were obtained. Secondly, a micro programmable pitch-tunable grating based on the silicon-on-glass technology was introduced and fabricated. By changing the driving voltage from 0 V to 45 V, the grating pitch is increased from 10  $\mu\text{m}$  to 20  $\mu\text{m}$  respectively and accordingly, the measured first-order diffraction angle is changed from 3.86deg to 1.94deg for an incident laser of 650 nm. This property enables the pitch-tunable grating suitable for optical switch applications. [C776]

### "A novel method for the manufacture of MEMS devices with large exposed area based on SOI wafers"

This paper describes a novel method of producing released MEMS devices with large exposed area based on SOI wafers. First, we discussed when the notching effect happens, from our experiments, for 30  $\mu\text{m}$  SOI wafer, the gap between lines should be below 14  $\mu\text{m}$  to initiate notching. Then, the release structure for the large exposed area device is designed, which opens up opportunities for the design of devices with large movement capabilities. A silicon temperature sensor with large exposed area is used to demonstrate the proposed method. Observations of the release structure at various stages of removal confirm our method; the device has been released use the one-step process and the large exposed area cleared without dasiagrasspsila effect. [C777]



### "Preparation of kerosene based nano-magnetic fluid and its application in pressure difference sensors"

A new-style functional nanomaterial-magnetic fluid and its preparing technology was studied. The preparing method of the kerosene based nano-magnetic fluid was presented and the characteristic of the magnetic fluid was studied. The principle and inductance calculation of the pressure difference sensor with magnetic fluid was presented based on the fluidity and paramagnetism of magnetic fluid. The calculated voltage difference was proportional to the difference of the magnetic fluids in the limbs and inverse ratio to the square of the coil length. The results demonstrated that the design and the research work of the pressure difference sensor with magnetic fluids is feasible. [C778]

### "Nano-electronics of high $\kappa$ dielectrics on InGaAs for key technologies beyond Si CMOS"

The surface Fermi level unpinning in InGaAs has been realized with high kappa dielectric growth using molecular beam epitaxy (MBE) and atomic layer deposition (ALD). Furthermore, world-record device performances in self-aligned inversion-channel InGaAs MOSFET and a capacitance equivalent thickness (CET) of less than 1 nm in Ga<sub>2</sub>O<sub>3</sub>(Gd<sub>2</sub>O<sub>3</sub>) and ALD-HfO<sub>2</sub> on InGaAs have been achieved. [C779]

### "Finite elements study of high mechanical stress in nanostructures for innovative NEMS sensors"

Mechanical stress is increasingly applied in micro-electronics. For instance, strained silicon technology is widely used to improve carrier mobility and therefore drive current for advanced MOS transistors. For micro-electromechanical systems, piezoresistive effects are universally employed in pressure sensors. In this paper we present an original method for studying mechanical stress in nano-devices placed on ultra-thin membranes, which has several advantages compared with the conventional four-point-bending method. Using this new architecture, we investigate the innovative NEMS pressure sensor properties in static and dynamic modes. We study the optimal orientation and position of a nanowire on the membrane. We show that a large improvement in pressure measurement sensitivity can be obtained by adopting tunnel junction technology. We also investigate the dynamic multi-bends of the nanostructure in its dynamic deformation modes and calculate the tunnel current which passes through the multi tunnel junctions by the transport matrix method. Finally, our work helps to understand the electrical and mechanical properties of the nanostructure under the influence of large mechanical stress and to design innovative NEMS pressure sensors. [C780]

### "Kinetic and processing studies on a novel technology of producing high purity nano-silicon dioxide from an alumina rich coal fly ash with carbon dioxide"

To further enrich aluminum content in coal fly ash so as to reduce the cost of it as a resource for industrial aluminum extraction, a novel process was developed to separate silicon from the rest of fly ash. The process was conducted by treating the coal fly ash with high concentration sodium hydroxide solution to dissolve silicon as sodium silicate at room temperature under atmosphere. The sodium silicate solution was separated from the high aluminum residue by filtration and was then subjected to treatment with carbon dioxide. When pH of the solution was reached at value A, carbon dioxide ventilation was interrupted and the step was called first carbonization. The filtrate obtained by filtration of the mixture from the first carbonization was subjected to the second carbonization at the same conditions. When pH of the filtrate was reached at value B, carbon dioxide ventilation was terminated and the residual coal fly ash was obtained by filtration. The whole procedure was named as two-step carbonization process. A highly purified nano-silicon dioxide product, in size of 50 nm and with purity of 96%, was obtained after washing the coal fly ash residue with water and acid. The processing samples were characterized by transmission electronic microscopy (TEM), X-ray diffraction (XRD), and infrared spectroscopy (IR) to illustrate the mechanism of the two-step carbonization process. Major reaction in the first carbonization was taken place between sodium hydroxide and carbon dioxide. Significant amount of heat was produced by this reaction. At the same time only a small portion of sodium silicate reacted with carbon dioxide. Most impurities were removed as a result of their adsorption on or reaction with the precipitate produced. The major reaction for the second carbonization was the reaction between sodium silicate and carbon dioxide. Silicon dioxide was precipitated in this step but no significant heat produced. Concentration changes of sodium hydroxide and sodium carbonate in the first carbonization and sodium silicate in the second carbonization were monitored to reveal the kinetic characteristics of the two-step carbonization process. It was found that the reaction was controlled by the mass transferring resistance on the liquid membrane. The first carbonization was a pseudo-first order rapid reaction between carbon dioxide and sodium hydroxide. The second carbonization, a medium fast multi-phase reaction between carbon dioxide and sodium silicate, was classified as second order reaction. The expressions of mass transfer rate were derived, and the criterion M value was obtained. [C781]



### **"Infrared heating and roller-based contact printing technology for the fabrication of micro/nano-structures"**

This paper presents a new roller-based nano-imprinting method based on the Infrared assisted metal transfer technique. It utilizes a silicon mold which is deposited with a thin metal film for pattern transferring. Another metal film which acts as an adhesion layer is also deposited on the substrate surface. An infrared light source incident from the substrate side heats up the metal films. After imprinting, the patterned metal film defined by sub-micro- and nano-scale features of the mold can be transferred from the mold to the substrate. A glass roller is introduced in this new method. Optically, the glass roller is acting like a cylindrical lens which can focus the infrared light into a line source at the mold/substrate interface. Mechanically, the roller provides a constant line-type contact pressure between the mold and substrate. In this paper, quartz substrates have been successfully patterned and, after appropriated etching processes, quartz molds are obtained. [C782]

### **"Fabrication and characterization of nano-scale lines through anodic porous alumina membrane"**

Anodic Porous alumina membranes are fabricated with different pore sizes through second oxide technique by changing the acid electrolyte and the anodization voltage. The pore diameter value and interpore distance are evaluated through SEM images. Nanostructure patterns with nanometer scale lines can be obtained on the cleaved cross-section of porous alumina membrane. Nano CD (NCD) linewidth standard product lines are prepared in this way. The linewidth roughness (LWR) and line edge roughness (LER) have been evaluated by analyzing top-down scanning electron microscope (SEM) images off-line using image processing and analysis technology. The average linewidth is less than 40 nm and the LWR and LER are estimated. [C783]

### **"Temperature controlled miniaturized cell in magnetic beads handling system for bio-chemical reaction"**

We proposed a temperature-controlled miniaturized cell for use in a magnetic beads handling system for bio-chemical reaction, especially for PCR usage, and created it by using conventional high-precision processing technologies. The proposed system consists of four temperature-controlled cells (designed for PCR use), a flow channel, a permanent magnet, and a compact linear actuator for driving the magnet. We introduced a miniaturized metallic armor and covered the cell unit with it to increase the liquid temperature uniformity in a cell. We experimentally evaluated the temperature distribution of the system by using thermography, and obtained a temperature distribution in the center (3.5 times 3.5 mm) that was less than 1.0degC. [C784]

### **"Toward self-assembly of phage-like nanorobot"**

The assembly of DNA nanostructures can allow for promising nanometer-sized machines. Synthetic DNA motifs are known to assemble into a wide range of nanoarchitectures by sequence programming. For the purpose of constructing strictly-controlled biological nanomachines, we design the self-assembly system consisting of DNA strands with the ability of producing a functional molecule. In this work we demonstrate that DNA motifs can form the programmed structure without loss of the target function. These results indicate that synthetic DNA molecules can provide both a packaging framework and an inner function to construct a phage-like nanorobot. We expect that our design concept makes a contribution to the establishment of the platform technology for new biomolecular machines to control biological systems in the natural environment. [C785]

### **"Multiscale thermoelectric imaging for fast metrology and manipulation"**

The latest scanning probe technology permits the same probe tip to carry out all of the imaging, characterization and manipulation operations. This multifunctional capability assists in a wide variety of applications, but low endurance and speed continue to be important problems to solve. We decouple the imaging and manipulation aspects of a probe device by implementing a thermoelectric imaging mode that functions entirely out of contact. In this new "off-contact mode," speeds can be accelerated up to two orders of magnitude relative to typical scanning probe microscopy scan speeds without damaging the probe tip. Combined with the nanoscale resolution provided by the tip while in contact, a single scanning probe can perform imaging and manipulation with multiscale resolution. [C786]

### **"Fabricate planar photonic crystal gradient index lens by laser interference lithography"**

Four-beam laser interference lithography (LIL) was shown to be a good technology to generate graded-index photonic crystals with a square lattice. Characters of the structure vary regularly with the incident angles and relative thresholds. The finite-difference time-domain method was used to validate the focusing behavior of the resultant structure. High intensity enhancement and sub-wavelength focusing were achieved simultaneously. The results suggest to us that LIL is a new low-cost and high-efficiency way of fabricating planar lenses. [C787]



### "Droplet and Dielectrophoresis deposition of single-wall carbon nanotubes"

Carbon nanotubes present remarkable characteristics as sensitive layer for a broad area of sensors-based applications (e.g. gas sensors for environmental monitoring, sensors for bioaffinity assays, DNA sensors). In the last years, the possibility to implement nanotubes as interface for improving the adhesion properties between cell and Microelectrode Arrays (MEAs) in electrophysiological assays (e.g. neuronal cells line) has been also proposed. In this field different applications require selecting the most suitable and well characterized methodologies for nanotube deposition and growth. In this aim, an important task is to guarantee at the meantime lifetime, device reproducibility and reduced dispersion effects after a nanotubes deposition procedure. This is a key factor if a fabrication technology has to be selected and implemented in a device batch production perspective. In spite of tremendous efforts done in this field at the present state-of-the-art this still is an open issue. We report our approach to synthesis and characterization of SWNTs, and two different methodologies for CNT deposition, aimed to be implemented in a micro-fabrication process for a large series production of micro-devices. Gas sensors and MEAs have been proposed as technological platforms to evaluate the reported methodologies. Future works will be addressed to the optimization of the full cycle of the device microfabrication line. [C788]

### "Ionic conductivity of the yttria-stabilized-zirconia nanomaterials"

Yttria-stabilized zirconia has practical applications as an oxide ion conductor in several electrochemical devices (e.g. SOFC). It's expected that a formation of zirconia nanomaterial allows to improve its electrical properties. The investigated nanomaterials were prepared by sintering of the filter-pressed zirconia nanopowders. SEM observations reveal uniform microstructure with isometric grains which sizes were from 90 to 300 nm depending on yttria content. Influence of the grain size on the bulk and grain boundary conductivity as well as on the respective activation energy was observed. [C789]

### "Strain effects on the band structure for Si nanowires"

The present paper discusses the strain effects on the conduction and valence bands for Si nanowires using k.p Hamiltonian, where, in addition to the usual radial symmetric strains, the torsional strain, being unique to axial symmetric devices, is also studied. The radial compression/expansion, analogous with the biaxial strain in planar devices, gives linear increase/decrease in the conduction band energy whereas for valence bands, multiband-specific edge shifts and effective mass changes are discussed with effective mass ellipsoid. The torsional strain only lowers the four-fold conduction subband for [110] nanowire, which is associated with normal strain in crystal coordinate. The torsion also raises the valence band energy with no substantial changes in effective masses. For the valence band, it is also suggested that the diagonal sum for inverted effective mass nearly unchanged under strain application. [C790]

### "A technology aware magnetic QCA NCL-HDL architecture"

Magnetic quantum dot cellular automata (MQCA) have been recently proposed as an attractive implementation of QCA as a possible CMOS technology substitute. Marking a difference with respect to previous contributions, in this work we show that it is possible to develop and describe complex MQCA computational blocks strongly linking technology and having in mind a feasible realization. Thus, we propose a practicable clock structure for MQCA baptised  $\Gamma, B_i$ snake-clock $\Gamma, B_i$ , we stick to this while developing a system level hardware description language (HDL) based description of an architectural block, and we suggest a delay insensitive Null Convention Logic<sup>TM</sup>(NCL, ) implementation for the magnetic case so that the  $\Gamma, B_i$ layout=timing $\Gamma, B_i$  problem can be solved. Furthermore we include in our model aspects critically related to technology and real production, that is timing, power and layout, and we present the preliminary steps of our experiments, the results of which will be included in the architecture description. [C791]

### "Carbon nanotube alignment using meniscus action"

Effective, large-scale alignment of single-walled carbon nanotubes (SWNTs) is necessary for making them a useful nanoelectronic technology. While techniques have been developed to align SWNTs during growth or through dielectrophoresis, no technique to date can align SWNTs on a large-scale while controlling SWNT density and taking advantage of chirally pure SWNTs. We present a novel alignment technique using mechanical action only through lateral meniscus movement between a hydrophobic and hydrophilic surface. The SWNTs have an average alignment of  $94.6 \pm 31.9^\circ$  relative to the meniscus motion direction, with a SWNT density of  $\sim 7$  SWNTs/ $\Gamma, B_i$ m. We also show that that our technique can easily be extended to a larger, manufacturing-type process. [C792]



### "Silicon nanowire transistor with a channel width of 4 nm fabricated by atomic force microscope nanolithography"

The emergence of an ultrasensitive sensor technology based on silicon nanowires requires both the fabrication of nanoscale diameter wires and the integration with microelectronic processes. Here we demonstrate an atomic force microscopy lithography that enables the reproducible fabrication of complex single-crystalline silicon nanowire field-effect transistors with a high electrical performance. The nanowires have been carved from a silicon-on-insulator wafer by a combination of local oxidation processes with a force microscope and etching steps. We have fabricated and measured the electrical properties of a silicon nanowire transistor with a channel width of 4 nm. The flexibility of the nanofabrication process is illustrated by showing the electrical performance of two nanowire circuits with different geometries. The fabrication method is compatible with standard Si CMOS processing technologies and, therefore, can be used to develop a wide range of architectures and new microelectronic devices. [C793]

### "Implementable building blocks for fluctuation based calculation in single electron tunneling technology"

Generally speaking, fluctuations and noise are unwanted factors interfering with the operation of devices and circuits, and their effect is becoming stronger as the fabrication technology feature size is decreasing. Recently, single electron tunneling (SET) circuit implementations were proposed for two building blocks that were designed for Brownian motion circuits, i.e., circuits which instead of trying to suppress fluctuations (noise) are taking advantage of it. These are the so-called Hub and Conservative Join. The Hub provides its output to other building blocks by repeatedly offering its state at its output terminals, and taking it back when it cannot be delivered. Based on a random scheme of signaling, the Hub requires fluctuations to drive its operation. The other building block, the Conservative Join, is designed to work in cooperation with the Hub, though it does not require fluctuations. Those two building blocks constitute a universal set thus any logic function can be implemented only with such blocks. However, the proposed implementations require topologies and circuit parameters that are not realizable for the state of the art fabrication technology. This paper presents single electron tunneling (SET) circuit implementations for the two building blocks which are taking into account realizability constraints. We propose novel SET circuit topologies for both blocks that satisfy topology and circuit parameters constraints and analyze their behavior at a temperature of 1K by computer simulations with SIMON 2.0. We demonstrate that the two different modes of operation in the blocks, fluctuation vs. non-fluctuating, can be accommodated by appropriately tuning circuit parameters. Utilizing these proposed topologies we then present an example of a half adder circuit constructed using the two building blocks and demonstrate that it functions correctly by means of simulations. [C794]

### "Magnetoresistive sensor based scanning probe microscopy"

Integrated sensors are essential for scanning probe microscopy (SPM) based systems where a large number of cantilevers are employed in parallel for high-throughput. However, common integrated sensors such as piezoresistive, piezoelectric, capacitive and thermoelectric, suffer from low bandwidth and/or low resolution. In this work, a novel magnetoresistive (MR) sensor based scanning probe microscopy technique is presented which can detect the deflection of the cantilever with nano-scale resolution and a bandwidth in excess of 1 MHz. This technique is suitable for high-speed imaging using integrated sensors which can be fabricated using micro-electromechanical-system (MEMS) and thin-film technology to make large scale parallel-SPM devices. [C795]

### "Quantum dot infrared photodetectors: Advantages, challenges, and future research directions"

Quantum dot infrared photodetectors (QDIPs) are positioned to become an important technology in the field of infrared (IR) detection, particularly for high-temperature, low-cost, high-yield detector arrays required for military applications. By addressing critical challenges inherent to epitaxial quantum dot (QD) material systems, the performance and applicability of QDIPs will continue to improve. In particular, three main approaches to combat epitaxial growth challenges and to obtain state-of-the-art performance in QDIPs are presented. First, epitaxial growth techniques designed to obtain uniform dopant incorporation in QD ensembles are reviewed. Second, bandgap engineering in QD heterostructures is presented as a tool to control device performance. Third, innovative photonic structures are discussed as a technique to increase and control absorption of incident IR radiation in QDIP heterostructures. Finally, preliminary investigations of a fundamentally different QD material system, namely colloidal QDs, are presented as a future direction of QDIP research. [C796]

### "Influence of the composition of MWCNTs layers on the properties of strain gauges"

Strain gauges based on multi-walled carbon nanotubes (MWCNTs) realize a higher sensitivity and a larger



operation range than usual metallic strain gauges. Different technologies for CNT-layers have been realized. With the aim to find a suitable technology that allows the application of CNT strain gauges without use of adhesives. For this purpose two detergents (SDS: Sodium Dodecyl Sulfate and DOC: Deoxycholic Acid) and one polymer composite (PEO: Polyethylene Oxide) were used to manufacture CNT strain gauges. The I-V characteristics of all strain gauges are linear between 0 V and 5 V. The resistance change versus strain shows a quadratic behavior, so that sensitivity increases with applied strain. Therefore all SDS-CNT, DOC-CNT and PEO-CNT composite strain gauges show a linear dependence of the sensitivity factor on strain. With a much higher MWCNT concentration the PEO-MWCNT strain gauges reaches a higher sensitivity factor between 7 and 13. The average sensitivity factor of DOC-CNT strain gauges is by 7.5. [C797]

#### "Pattern generation by using high-resolution nanoimprinting and nanotransfer printing techniques"

Nanofabrication is the core task performed and constantly further developed by today's and future semiconductor industry. Optimization of throughput and minimizing process cost and complexity thus increasing fabrication reliability constitute the main challenges within this development. Printing techniques play a crucial role in nanofabrication since they are offering the capability of large area patterning while simultaneously holding overall process time shorter than when using any other conventional nanolithography technique. Our work in this field focuses both on the development of new techniques and materials for nanoimprint lithography (NIL) technology as well as on the fabrication of several components for innovative devices and systems for different applications in the area of nano- and molecular electronics. With the aim of pushing the patterning resolution in the sub-10 nm region, we introduce a room-temperature NIL (RTNIL) technique, which uses molds that are fabricated by molecular-beam-epitaxy (MBE). MBE growth processes allow for precisely controlling the thicknesses of grown crystalline layers with sub-5 nm resolution. This resolution directly determines the minimum size of the mold features to be imprinted. We have designed and built a new NIL-tool that is capable of performing single-step RTNIL using MBE-molds that we fabricated. With help of the same tool, we have successfully fabricated planar nanogap electrodes of predetermined spacing using direct high-resolution metal nanotransfer printing (nTP) on a solid substrate. Our recent progress in developing imprint processes for directly patterning organic semiconducting polymers such as poly(3-hexylthiophene) (P3HT) is also shown. [C798]

#### "Exploring spray technology for the fabrication of organic devices based on poly(3-hexylthiophene)"

In order to fully exploit the potential of polymer electronics, large-area/low-cost processing technologies are necessary. In this paper, we investigate the feasibility of air atomizing spray technology for large-area/low-cost fabrication of organic electronic and optoelectronic thin-film devices based on solution-processable polythiophene derivatives. For this purpose an airbrush coating system was implemented and two main classes of organic devices were fabricated, organic photodetectors (OPD) and organic thin-film transistors (OTFT). Electrical and electro-optical characteristics, as well as film morphology and roughness of spray coated devices were compared to those of spin coated ones fabricated with similar structure. Although films deposited by spray coating show a considerably higher surface roughness and lower overall homogeneity, the spray-coated devices are capable of achieving performances comparable to the spin-coated ones. [C799]

#### "DNA-functionalized nanopores for single molecule analysis"

The use of biological  $\alpha$ -hemolysin pores as sensors for single molecules like DNA was recently demonstrated: the passage of the molecules through the pore separating two electrolyte-filled reservoirs is induced by a voltage application and detected as a current drop. Present attention is devoted to solid state nanopores, with obvious advantages, such as high stability, control of diameter, adjustable surface properties and the potential for integration into complex devices. We present results on DNA-functionalized solid state nanopore devices produced by using a Focused Ion Beam, to obtain an high throughput platform for gene expression profiling, that is for the rapid molecular diagnosis of tumours and other genetic diseases. [C800]

#### "Behavioral model of carbon nanotube programmable resistors"

Hybrid Nano (e.g. Nanotube, Nanowire) /CMOS circuits combine both the advantages of Nano-devices and CMOS technologies; they have thus become one of the most promising candidates to relax the intrinsic drawbacks of CMOS circuits beyond Moore's law. A behavioral simulation model for an hybrid Nano/CMOS design is presented in this paper. It is based on Optically Gated Carbon NanoTube Field Effect Transistors (OG-CNTFET), which can be used as 2-terminal programmable resistors. Their resistance can be adjusted precisely, reproducibly and in a non-volatile way, over three orders of magnitude. These interesting behaviors of OG-CNTFET promise great potential for developing the non-volatile memory and neuromorphic adaptive computing circuits. The model is developed in Verilog-A language and implemented on Cadence Virtuoso platform with Spectre 5.1.41 simulator. Many experimental parameters are included in this model to improve the simulation



accuracy. [C801]

### "Finite frequency response of nano magnetic structures"

We apply the Holstein-Primakoff and Bogoliubov transformations to compute the spin wave states of small magnetic structures including the effect of the dipolar interaction. We found that as the film gets thicker, states with a significant  $q=0$  component are hybridized with states with higher Fourier components. Surface states that are responsible for magnetization reversal are coupled to the extended states. In the presence of a static magnetic field opposite to the magnetization direction, the response function is increased by an order of magnitude. This suggests an intriguing scenario for assisted switching of the magnetization with an additional external a.c. field. Nonlinear effects are discussed. [C802]

### "Fast and compact simulation models for a variety of FET nano devices by the CMOS EKV equations"

In this paper we explore the possibility of using the equations of a well known compact model for CMOS transistors as a parameterized compact model for a variety of FET based nano-technology devices. This can turn out to be a practical preliminary solution for system level architectural researchers, who could simulate behaviourally large scale systems, while more physically based models become available for each new device. We have used a four parameter version of the EKV model equations and verified that fitting errors are similar to those when using them for standard CMOS FET transistors. The model has been used for fitting measured data from three types of FET nano-technology devices obeying different physics, for different fabrication steps, and under different programming conditions. [C803]

### "Prospects for building cortex-scale CMOL/CMOS circuits: A design space exploration"

In this paper, we briefly present a hardware design space exploration methodology to investigate various architectures/designs, and their relative performance/price trade-offs. Using this methodology, we investigate CMOS and hybrid nano-scale (CMOL) based digital and mixed-signal circuits that implement Bayesian Memory (a simplified computational model based on George and Hawkins' model of the visual cortex, and Pearl's belief propagation), and for a cortex-scale spiking neural model. We then present the results of the hardware design space exploration, for implementing large-scale neuro/cortex inspired systems, and provide ballpark performance/price and scaling estimates for the same. These results provide some insight into the prospects for building large-scale Bayesian Inference engines, and neuromorphic networks using emerging nanoelectronics and/or nanogrid circuit structures. In general, the study of such hypothetical architectures will help guide research trends in intelligent computing (including neuro/cognitive systems), and the use of radical new device and circuit technology in these systems. [C804]

### "A robust method to estimate Power and Delay for Digital Integrated Circuits"

Advancements in nano-scale Integrated Circuits manufacturing technology has resulted in variability of performance metrics. The performance parameters such as Power and Delay are no longer represented deterministically. As a result, circuit designers and manufacturers need to make use of statistical analysis to estimate performance of Integrated Circuits. In this paper we present a new methodology to increase the accuracy of estimation compared to prior methods. We introduce Bayesian analysis as a powerful mathematical and statistical approach to incorporate the prior observations in calculating the Probability Density Function (PDF) of performance parameters like Power and Delay. We apply this technique on a few Digital Gates and compare the results with previous methods. We also introduce Bayesian analysis as a powerful method to update the PDF of performance parameters. Finally, we demonstrate how this statistical approach could supersede the approaches established on Frequentist analysis so as to achieve a more accurate estimation on Power and Delay for Digital Integrated Circuits. [C805]

### "A link failure aware routing algorithm for Networks-on-Chip in nano technologies"

As nanotechnology scales down, the reliability issues are becoming more crucial, especially for Network-on-Chip (NoC) which must provide the communication requirements of Multi-Processor System-on-Chip (MP-SoC) even in presence of faults. In this paper we present a low cost faulty-link-tolerant routing algorithm through dynamic reconfiguration when the regular mesh topology is altered by faulty links. This algorithm is a reconfigurable extension of deterministic routing algorithms and is deadlock free by prohibiting a few turns. The performance and total energy consumption overheads which are very small under the low loads are evaluated through appropriate simulations. [C806]



### "Muscle-powered nano mechanical system assembled by optical tweezers"

This paper describes assembly of three dimensional cellular structure by optical tweezers. We attempted to construct a three dimensional quasi living machine in small space with muscle cells. Cardiomyocytes were manipulated by using laser optical tweezers at wavelength of 1064 nm. The cellular bridge structure was successfully constructed on between PDMS micro pillars. The viability and contraction of that was confirmed. We also demonstrated a nano assembly of a cell-driven nano-mechanical tweezers by using a optical tweezers. The nano mechanical tweezers was designed as single cardiomyocyte contraction force for a nano actuator. A myocyte contraction force is tiny force such as  $<10 \text{ fN}$ , however it is enough large power to drive the nano mechanics. This nano mechanics was three-dimensional carbon structure which was designed for nano tweezers. Focused ion beam induced chemical vapor deposition of the carbon nano mechanics. Optical tweezers allowed to combine the nano tweezers and a single beating cardiomyocyte on it. We demonstrated assembly of single cardiomyocyte powered nano tweezers, which had beams of 150 nm diameter and 20  $\mu\text{m}$  length, and live cardiomyocyte. [C807]

### "Threshold-voltage variations effects on the reliability of nano-scale CMOS logic gates"

The reliability of nano-scale devices and circuits has received revived attention in recent years. This paper focuses on the reliability at the gate level considering the variations of devices parameters. In particular, this study aims to quantify the effects of threshold voltage variations on the reliability of nanometer-scale CMOS logic gates. The reliability is quantified in terms of the probability-of-failure of individual gates, which is obtained from extensive Monte Carlo simulations of CMOS gates. The study considers the NAND-2 and majority-3 gates at 90 nm and 22 nm, and compares the effects of threshold voltage variations on the reliability of each gate. The results show a clear dependency pattern of reliability on the gate's input combinations. [C808]

### "Toxicity of toner nanoparticles on RT112 cell cultures"

The measurement of cell proliferation and cell viability has become a key technology in the life sciences. The need for sensitive, reliable, fast and easy methods has led to the development of several standard assays. These include the determination of DNA synthesis by measuring the amount of radioactive labeled nucleosides like  $[^3\text{H}]$ -thymidine incorporated in nucleic acid. Alternatively several tetrazolium salts, including MTT, XTT and MTS are usually used to assay cell proliferation and viability on microplate assays. Actually there is an immediate need for nanotoxicology the availability of rapid and inexpensive tools in order to carry out some preliminary test for nanomaterials and the aim of our work was to investigate on the feasibility of WST-1 assay for this purpose. In our aim we investigated the toxicity in term of cell proliferation of toner nanoparticles (5-50 nm) on human bladder carcinoma cell line RT112 by WST-1 assay and also to evaluate the feasibility to apply this method as tool for in vitro nanotoxicology studies. In order to relate the toxicity test results to the toner powder properties, chemical and physical-chemical analyses have been performed in parallel on the same batch sample. [C809]

### "Tunable elastomeric nanochannels for separation and manipulation of long DNA molecules"

Nanofluidic structures, such as nanochannels have been successfully used to confine and stretch DNA molecules, offering the opportunity of investigating on their conformational changes. Moreover, the integration of these confinement systems on lab-on-chips has shown a great potential for applications such as biomolecule sieving or single molecule manipulation. Arrays of nanochannels are fabricated on silicon substrates using a focused ion beam (FIB), replicated using polymers and soft-lithography techniques, and then sealed with a polymeric thin layer or a glass coverslip bonded using oxygen plasma. Elastomeric materials (e.g. poly(dimethylsiloxane)) are flexible and the application of small forces reversibly modulates the nanochannel cross section affecting the size of the molecules passing through it. [C810]

### "Biomorphic transformation to obtain hierarchical porous structures"

Hydroxyapatite (HA) bone scaffolds characterized by highly organized hierarchical structures have been obtained by chemically transforming native woods through a sequence of thermal and hydrothermal processes. The five steps of the phase transformation process have been set up in order to achieve total phase conversion and purity maintaining the original native microstructure. The composition of the final wood-derived scaffolds was carbonated apatite hierarchically structured in parallel fastened hollow microtubules. The biomimetic composition and the highly anisotropic morphology and open-pore geometry obtained by biomorphic transformation confer potentially improved biomechanical characteristics to these new inorganic bone scaffolds, thus they can represent potential solutions for regenerating long and load-bearing bone segments. [C811]

### "Density functional theory analysis of SiO<sub>2</sub>-oxynitride interfaces"



Two different interface models for crystalline oxynitride on SiO<sub>2</sub> are proposed and investigated. The two models are proposed to model oxynitride gate stacks on Si substrate with SiO<sub>2</sub> as the interlayer film. State-free insulating interfaces were obtained by expanding the bulk oxynitride cell by approximately 12% and 1% to match the lattice constant of SiO<sub>2</sub> along the [100] and [010] axis respectively. The results that were obtained demonstrate state-free insulating interfaces for the two models with, however, valence band offsets of 0.1 eV and 1.45 eV respectively. The significant decrease in the valence band offsets is attributed mainly to the significant expansion of the oxynitride's lattice constant to lattice-match (001)SiO<sub>2</sub>, as well as, to the high concentration of nitrogen atoms in the interface. [C812]

#### "Single cells electrical characterizations using nanoprobe via ESEM-nanomanipulator system"

We perform electrical characterization on single cells using dual nanoprobe through environmental scanning electron microscope (ESEM)-nanomanipulator system. The ability to characterize the electrical property of single cells can be used as a novel method for cell viability detection in a quantitative and fast manner. The nanoprobe has been successfully fabricated using focused ion beam (FIB) tungsten deposition and etching processes. The characteristics of the nanoprobe have been examined from the energy dispersion spectrometry (EDS) and noise analyses. In this paper, for the first time, the electrical property of single cells under their native condition was presented. In order to realize this method for cell viability detection, two types of cells were used, i.e. dead cells and live cells. The results showed that there is a significant difference on the electrical measurement data between dead and live cells. [C813]

#### "Shrinking solid-state nanopores and nanoslits using electron beam induced deposition with different precursors"

Solid-state nanopores of only a few nanometres in size have been in the spot-light during the last decade because of their potential use in applications such as molecule detection and DNA sequencing. They show greater stability than their biological counterparts, and can therefore be used in a broader range of environments. In most cases, the fabrication of such a nanopore requires the high-energy beam of a transmission electron microscope (TEM) or focused ion beam (FIB) tool to drill or reshape a small hole in a freestanding membrane. Here, we present a novel method to reduce the size of existing nanopores using electron beam induced deposition (EBID) in a conventional scanning electron microscope (SEM). The existing nanopores are etched in a silicon membrane using anisotropic wet etching and can be shrunk down to a few nanometres using EBID. In an unmodified SEM, shrinking can occur using the hydrocarbon contamination as a precursor, but we will show that by using a specifically designed environmental cell, it is possible to introduce different precursors and shrink the pore using almost any material desired. [C814]

#### "Evaluation of thermal conduction of single carbon nanotube by local heating in air"

We evaluated thermal conduction of a single carbon nanotube (CNT) in air. Heating the end of the CNT locally by a microheater, we measured temperature dependence of electrical resistance of the single CNT. First, we fabricated the microheater for local heating and four electrodes for electrical resistance measurement on a Silicon on Insulator (SOI) wafer and made a gap for heat insulation. The effectiveness of the SOI wafer and the gap was confirmed by FEM analysis. Next, the single CNT was manipulated on this pattern by nanomanipulation and fixed by Electron-Beam-Induced-Deposition (EBID) in the Scanning Electron Microscope (SEM). Finally, we measured the electrical resistance when the temperature of the microheater was changed by applying the voltage. As a result, we could evaluate the thermal conduction of a specific single CNT in air. This paper also indicates the possibility of using a single CNT as a temperature sensor. [C815]

#### "Low temperature wiring with Ag inks: New $\beta$ -ketocarboxylate Ag inks for 100 °C curing"

This paper summarizes a Ag carboxylate ink technology for patterning circuits on heat-sensitive substrates. Low temperature processes for making circuits is becoming one of the key issues for printed electronics primarily because of the potentials of heat-sensitive substrates such as PET films and papers. The authors have developed  $\beta$ -ketocarboxylate Ag inks that can be cured around 100 °C. The electrical specifications and microstructural observations of the new ink printed on commercial papers are demonstrated. [C816]

#### "How much input vectors affect nano-circuit's reliability estimates"

As the sizes of (nano-)devices are aggressively scaled deep towards the nanometer range, the design and manufacturing of future (nano-)circuits will become extremely complex and inevitably introduce more defects, while their functioning will be adversely affected by (transient) faults. Therefore, accurately calculating the reliability of future designs will become a very important factor for (nano-)circuit designers as they investigate several alternatives for optimizing the tradeoffs between the conflicting metrics of area-power-energy-delay



versus reliability. This paper studies the effect of the input vectors on the (nano-)circuit's reliability, and introduces a time-efficient method for quickly and accurately identifying the lower/upper reliability bounds. Simulations results support the claim that the absolute difference between the lowest and the highest achievable reliability is of one-to-two orders of magnitude. Therefore, future designs should consider the worst case input vector(s) in order to guarantee the required reliability margins. [C817]

#### **"New noise-tolerant dynamic circuit design"**

Dynamic circuit is suitable for high-speed application, but often suffers from noise related reliability problems which become increasingly prominent as the technology are entering into the scores of nano meter era. This paper presented a new dynamic circuit scheme, which could achieve higher noise margin without sacrificing much power consumption and delay time. This design achieves a higher noise margin (1.2 V) by finely tuning the transistor size. The effectiveness of new scheme is demonstrated in both NMOS series and parallel circuits. The simulation result shows that, compared with other published work, the proposed structure has the highest noise margin for the same power-delay product (PDP)<sup>1</sup>. [C818]

#### **"NANO materials and composites for electronic and photo packaging"**

The advances of semiconductor technology are highly dependent on the advances of polymeric materials. These include the use of polymers as adhesives (both conductive and nonconductive), interlayer dielectrics (low-k, low loss dielectrics), encapsulants (discrete and wafer level packaging), embedded passives (high-k and high-Q materials), superhydrophobic selfcleaning lotus effect surfaces, etc. In this presentation, we will review some of the recent advances of polymeric materials and polymer nanocomposites currently being investigated for these types of applications, such as lead-free electrically conductive adhesives (ECAs) for fine pitch and high current density interconnects, flip chip and wafer level underfills, superhydrophobic self-cleaning lotus effect surfaces, as well as high-k and high-Q nanocomposites for embedded capacitors and inductors. These nano materials and process will have important application in electronic and photonic packaging applications. [C819]

#### **"Carbon nanotube bundles as nanoscale chip to package interconnects"**

The paper presents recent advances in carbon nanotube interconnect modeling, with focus on their application to nanoscale chip packaging. An enhanced electrical model of carbon nanotube bundles is used, able to take into account the effects of different nanotube sizes covered by this application. The use of carbon nanotubes as chip to package interconnects at nanoscale dimensions is analyzed and the electrical parasitics introduced by these interconnects are compared to those predicted by other packaging technologies. [C820]

#### **"Local density of states and electronic transport properties of homotype SWCNTs bundles"**

Ribbons constituted by homotype bundles, i.e. made preferentially by carbon nanotubes having the same diameter have been analyzed. In particular the structural, morphological, and electronic properties have been evaluated. The measurements of the basic transport properties have allowed to fit the electronic behaviour of ribbons formed by the macroscopic aggregation of such homotype bundles to a model based on the coupling tunnelling conductance of highly aligned nanotube systems. The parallel arrangement of nanotubes with the same chirality in bundles and the resulting peculiar intertube interactions suggest a mean of controlling the LDOS by configuring different architectures. The dependence of the ribbon conductance on the temperature has been rationalized considering the presence, in a given ribbon, of both metal-like and semiconducting homotype bundles. In addition, photoconductivity properties of aggregated single-walled carbon nanotubes are also studied. [C821]

#### **"Silicon based nanogap device for investigating electronic transport through 12 nm long oligomers"**

We have fabricated vertical nanogap electrode devices based on Silicon-on-Insulator (SOI) substrates for investigating the electronic transport properties of long, conjugated molecular wires. Our nanogap electrode devices comprise smooth metallic contact pairs situated at the sidewall of an SOI structure, obtained by selective recess-etching a few nanometers thin buried oxide layer and subsequent thin film metallization. The electrodes are separated by a predetermined distance down to about 5 nm and feature a well-tailored material layer structure, as characterized by SEM and scanning TEM analysis. We studied the electronic transport properties of 12 nm long, specifically synthesized dithiolated oligo-phenylene-vinylene derivatives assembled onto the electrode gap from solution. In particular, we observed a pronounced, non-linear current-voltage characteristic featuring a large conductance gap up to approx.  $\Gamma_B \pm 1.5$  V. The occurrence of this gap can be assigned to energetic barriers originating from short conjugation-breaking linker groups at the termini of the molecule. Model calculations that involve Density Functional Theory (DFT) and Non Equilibrium Green's Function (NEGF) methods agree qualitatively well with the data. [C822]



### "Optimization of sub-100nm transistor gate sidewall spacer process for high-performance applications"

As the technology node advances to the next generation, one of the biggest challenges is to achieve minimum pitch while maintaining device performance. This paper describes the details of a novel manufacturing process integration of complementary metal oxide semiconductor (CMOS) transistor architecture, which is incorporated into a sub-micron logic technology on 300 mm wafers. As the gate length is scaling down, the spacer design for CMOS transistor becomes increasingly critical manufacturing process. Moreover, the material of the sidewall spacer itself plays an important role, and its impact on device performance has been intensively discussed. Fabrication process results show that the offset spacer configuration and width can effectively increase the on-state driving current and reduce the off-state leakage current off due to the high vertical fringing electric field effect arising from the side capacitor comprising of gate spacer extension structure. A novel semiconductor fabrication process on gate spacer technology and electrical performance of nano-meter gate structure was included. [C823]

### "Pulsed discharge plasma generated by nano-seconds pulsed power in atmospheric air"

Non-thermal plasma has been widely used for various applications. The observation of discharge plasmas is an essential aspect for understanding the plasma physics of this growing field. In this work, the propagation of pulsed discharges was observed by both framing and streak images and spectroscopy. The results showed two discharge phases exist in pulsed discharge with 100 ns in pulse width; streamer and glow-like phase. Between those two phases, the electrode impedance changed dramatically which causes impedance mismatching between the power source and electrode. In addition, the gas temperature increased about 150 K during the glow-like discharge, which causes further energy loss in plasma processing. Consequently, the decision became to remove the glow-like phase and only having the streamer discharge. A nano-seconds pulsed power generator was developed and the observed discharge plasma has the streamer phase only. Furthermore, its application of ozone generation showed highest energy efficiency than other discharge methods. [C824]

### "The Nano-Atomic-Clock"

AccuBeat LTD. is developing an innovative miniature atomic rubidium standard based on the coherent-population-trapping (CPT) phenomena. This standard, named nano-atomic-clock (NAC) is designed for very small size (~10cc) and very low power consumption (360mW). The NAC implements an extremely small "physics package" with a volume of 1cc. Although small in size and power the NAC achieves very high performance in terms of frequency stability. The CPT phenomenon is achieved by using light that contains two wavelengths that differ by the hyperfine ground transition of the 87Rb (6.84 GHz). The NAC compact size and the low power consumption are achieved by replacing the (power hungry) Rb lamp and a filter cell that are used in the current technology with a miniature low power laser diode (the VCSEL). In order to improve both the short and the long term stability, AccuBeat has implemented a multiple servo-loop sophisticated scheme. [C825]

### "MEMS-integrated ultra-wideband terahertz traveling wave tube amplifier"

An ultra-wideband TWT amplifier is being developed for THz communication, sensing, and imaging applications. Using FDTD-PIC simulation, we demonstrated that, for an electron beam power of 5 kW, a staggered double grating array produces 150 to 275 W, corresponding to 3-5.5% efficiency, at 0.22 THz over ~ 30% bandwidth with greater than 12 dB/cm growth rate. The Ka-band cold-test of this circuit has shown excellent agreement with both a theoretical model and simulation analysis in dispersion and attenuation plots, showing a 25% dynamic bandwidth and 0.15 dB/cm attenuation. The circuit has been fabricated by both UV LIGA and high precision CNC machining with ~ 2-3  $\mu$ m dimensional tolerance and ~ 30 nm surface roughness and its cold-test setup has been completed. The MEMS-fabricated 0.22 THz electronic circuit will be tested for its dispersion and attenuation measurement. Also, a scandate nano-powder (SC2O3-W) cathode has successfully emitted the requisite high current density electron beam of 80 A/cm<sup>2</sup>(space charge limited) at 1150 $\mu$ m, °C for 800 hrs and currently it is planned to incorporate it in the electron gun and PCM magnet design. [C826]

### "Field emission characteristics of carbon nano tubes under varying background pressure conditions"

In general, for plasma switches, the initiation of the plasma is critical and this is usually achieved by a  $\Gamma$ -trigger scheme. The seed electrons needed to initiate a breakdown can be generated by several means such as thermionic, field or optical emission. While the thermionic emission has been used mainly in vacuum tubes and is a mature technology, field emission (or cold-cathode electron emission) has been the subject of



recent studies and technology. The efficiency of these seed electron emission determines how well the plasma switch can close or open. It is known that the carbon nano tubes (CNTs) have excellent field emission characteristic under high vacuum pressure and they have been considered as prima candidates as cold-cathode electron emitters. However, to the authors' knowledge their electron emission characteristics in elevated pressures higher than vacuum have not been measured. The purpose of this experiment is to observe the field emission characteristics of several CNT samples, namely random Multi-Wall Carbon Nano Tube (MWCNT), Aligned MWCNT and random Single-Wall Carbon Nano Tube (SWCNT) in background pressures ranging from 10-6Torr to 1 Torr of He and air. The comparison of SEM images of the samples before and after the experiments is presented to demonstrate that these samples can be operated under these various vacuum conditions. [C827]

#### "Mixed-signal ICs in nano-scale technologies: Design and challenges"

Analog design issues, impacts of scaling on power consumption in analog circuit and device performance in nanoscale CMOS technologies are discussed. An example of simple and effective digital calibration scheme will be explained as a method of overcoming power device performance in the technology. Low voltage RF circuits for GPS and mobile TV applications and analog circuits that avoid operational amplifiers will be briefly covered. Finally possibilities of analog circuits that do not suffer from the 'fundamental'  $kT/C$  noise that we will call 'sub- $kT/C$  circuits will also be introduced as a potential pathway for low power analog circuits. Analog circuits that avoid operational amplifiers and transmission gates will be briefly covered. [C828]

#### "ILP based leakage optimization during nano-CMOS RTL synthesis: A DOXCMOS Versus DTCMOS perspective"

In this paper, an integer linear programming (ILP) based algorithm is presented that considers resource constraints and optimize leakage delay product (LDP) using a precharacterized register transfer level (RTL) library. For nanoscale CMOS (nano-CMOS) circuits leakage is a predominate form of power dissipation. Leakage optimization at the early stage of design cycle, such as during high-level synthesis is quite few. Two techniques, dual-Tox(DOXCMOS) and dual-V<sub>th</sub>(DTCMOS) technology are explored during the high-level synthesis for leakage optimization. The leakage is assumed to be sum of gate-oxide leakage and subthreshold leakage. Register transfer level (RTL) components are characterized for DOXCMOS and DTCMOS technology accounting for process variations, which is an important issue for nanoscale circuits. Experiments were performed on several high-level synthesis benchmark circuits, which show an average reduction of 79% gate leakage and 76% of subthreshold leakage for DOXCMOS and DTCMOS technology, respectively. It is observed that DOXCMOS technology based optimization out performed the results from DTCMOS technology based optimization. [C829]

#### "Copyright"

The following topics are dealt with: artificial neural networks; biodegradability prediction; cellular automata; evolutionary algorithms; swarm intelligence; emergent systems; artificial life; Lindenmayer systems; digital organisms; artificial immune systems; membrane computing; simulated annealing; communication networks and protocols; computing with words; common sense computing; cognitive modeling and architecture; connectionism; metaheuristics; hybrid approaches; quantum computing; nano computing; information retrieval; robotics; fault diagnosis; bioinformatics; Web intelligence; speech processing; business information systems; knowledge management; evolvable hardware; image and signal processing; pattern recognition; traffic and transportation system; decision analysis; data mining; computer vision; information and communication technology; control system. [C830]

#### "Study of biomineralization processes by cryo-TEM"

The present work describes the study of the biomineralization process of biohybrid composite for bone substitution and repair. The material was developed nucleating apatitic phases on self assembling collagen fibers, acting as a template. Using cryogenic transmission microscopy (cryo-TEM) it is possible to freeze material specimens at different times of the mineralization process and then observe the vitrified samples at cryogenic temperature. The preparation procedure of the specimens was set up. The nucleation of the apatitic phase on the collagen was observed from the beginning of the synthesis and the time needed for the complete assembling of the collagen fiber was determined. [C831]

#### "Nano-magnet based ultra-low power logic design using non-majority gates"

In this paper we explore the intriguing possibility of nano-magnet based logic using non-majority gates. The design approach can offer significant area, delay and energy advantages, compared to a majority-gate based



logic design. Our analysis based on NAND-gate based ring-oscillator (RO) shows an improvement of 29% in frequency and 33% in area compared to MQCA based design. Moreover, using the performance metric of millions of operations per second per micro-watt power (P) per micron square area (A)-MOPS/P/A, our RO design with narrow gap cladding HCLOCKenhancement, shows an improvement of 13X compared to an RO in 15 nm CMOS technology. [C832]

#### "Metal nanojunctions on silicon single nanowire devices"

Direct patterning of silicon dioxide by electron beam lithography is used for the definition of metal nanojunction on wires fabricated on silicon on insulator (SOI) substrates. Devices based on a single silicon nanowire as small as 15 nm and several micrometers long are fabricated by means of a top down process based on electron beam lithography, silicon anisotropic etching and thermal oxidation. A metal gate is defined over a nanoscale opening into the silicon dioxide surrounding the wire obtained by means of the electron beam stimulated oxide etching. The behavior of the device like a silicon nanowire junction field effect transistor (SiNW-JFET) is confirmed by the electrical characterization at room temperature. [C833]

#### "Morphology and magnetic properties of island-like Co films obtained by de-wetting as catalysts for carbon nanotube arrays"

Interest in the growth of carbon nanotubes by chemical vapor deposition technique using transition 3d metals as catalyst support is still a subject of intense research. In this paper, we report the morphological and magnetic properties of Co films with varying thickness prior to and post de-wetting that enabled the formation of island-like structures. Interestingly enough, we found different magnetic states as a function of Co thickness and grain size. Moreover, the island-like Co films morphology will enable the subsequent development of carbon nanotube arrays that may enclose and/or embed the nanoparticles useful for multiple technologies. [C834]

#### "Geometry dependent I-V characteristics of gold atomic-sized contacts"

Atomic-sized contacts have attracted significant attention by continuing miniaturization of nanoscale electronic components for the two past decades. In present work, the electronic transport properties of gold atomic-sized contacts are studied using the non-equilibrium Green's function technique on the density functional tight binding method for modelling the geometry dependent I-V characteristics. The gold contacts are sandwiched between (001) electrodes, and the electronic current is deduced according to the Landauer formulation to study the effect of contact geometry structure. [C835]

#### "Nanoscale reconfigurable computing using non-volatile 2-D STTRAM array"

In this paper, we investigate the combination of a novel computing paradigm referred to as Memory Based Computing (MBC) and an emerging non-volatile nanoscale memory technology, namely Spin-Torque Transfer Random Access Memory (STTRAM), to build a reconfigurable nanocomputing framework with high integration density, robustness and energy-delay efficiency. MBC uses a 2-D memory array as underlying computing element. Noting the read-dominant access pattern in MBC, we optimize the STTRAM cells to increase the energy-delay efficiency. Further, exploiting the asymmetric nature of the cells, we introduce the notion of preferential storage which optimizes the cell performance for '1' over '0' and skew the LUT content toward '1' for improved energy-delay product (EDP). [C836]

#### "Micro and nano product engineering using data management for silicon-based fabrication process development"

Product engineering of micro and nano technology (MNT) devices differs substantially from product engineering in more traditional industries. The general approach is mostly bottom up, as it centers around the available fabrication techniques. The strong emphasis on manufacturing technology in this area leads to a large number of application specific fabrication processes. In the first part of this paper we introduce a comprehensive customer-oriented product engineering methodology for MNT products. The MNT product engineering process is analyzed for different business cases with regard to application-specific procedures and (data) interfaces. An existing environment for the development of MNT manufacturing processes has been identified as a technical foundation for the methodology and will be described in the second part of this paper. [C837]

#### "Nanoelectronics lab based on nanogap fabrication"

Nanotechnologies have a large application to different fields of science and technology, and it is possible to find, in a nanodevice or nanosystem development, some common needs and technical solutions. Aim of this work is to setup a novel approach to prepare a general device for management of nanostructures production and



management, giving to researchers the opportunity to work on their specific application and having an already prepared working base, ready to be extended and customized to specific design needs. The idea is to develop this new concept starting from a real application in which authors have an already matured experience, nanogap fabrication for nanoelectronics and sensors. [C838]

#### "Micro/nano grip and move compliant mechanism with parallel movement tips"

The development and deployment of micro and nano-electro-mechanical systems (MEMS/NEMS) are critical to the economy of each country and society because these technologies will lead to major breakthroughs in information technology and computers, medicine and health, manufacturing and transportation, power and energy systems, and avionics and national security. The assembly of micro-devices involves handling of parts that are extremely very small. This paper presents the design of compliant grip and move manipulators with parallel movement tips. The integration of both gripping and moving manipulators with parallel movement tips is accomplished by the use of compliant mechanisms, which generate paths that are symmetric. The structural topology optimization approach is applied in order to find the optimal material distribution in the proposed domain for compliant mechanism. A 2-D finite element analysis (FEA) model using ANSYS is constructed for the propose design domain. The optimal configurations of the compliant mechanism, which can realize a micro grip and move with parallel movement tips, is demonstrated. [C839]

#### "Beads, boats and switches: Making things happen with molecular photoswitches"

In this paper we present recent results obtained with a stimulus-responsive materials based on the photo-switchable behaviour exhibited by spiro-cyclic derivatives. Our results suggest that these highly novel materials offer unique capabilities hitherto inaccessible using conventional materials. In particular, we will focus on photocontrolled guest binding and release, inherent signalling of status, photo-actuation and solvent driven motion of small structures as examples of the fascinating behaviour of these exceptional materials. [C840]

#### "Field emission behaviour of nickel nanowires grown by electrochemical deposition"

In this work, aligned nickel nanowires have been fabricated by electrodeposition using anodic alumina oxide templates with 200 nm pore dimension. With this low cost deposition technique, a uniform filling of the membrane has been obtained with an height of the nanowires of 2  $\mu\text{m}$ . The field emission characteristics of the prepared NiNWs have been measured demonstrating, after a conditioning step, a stable behaviour that follows the Fowler-Nordheim law. A current density of 17,8  $\text{A}/\text{cm}^2$  is obtained for an applied voltage of 570 V. A non-linear Fowler-Nordheim plot has been observed at high electric field that can be attributed to the non uniform field enhancement factor of the different nanowires. [C841]

#### "A crosstalk minimization technique for sublithographic programmable logic arrays"

The emergence of alternative technologies due to continued technology migration into the nanometer regime has led to the design of several novel logic and memory architectures. These architectures, in particular array based architectures built from crossbar structures, aim to achieve higher logic/memory densities with lower power consumption and acceptable delays as compared to present day CMOS technology. However crosstalk induced in these nanoscale arrays limits the minimum wire spacing realizable and thereby the logic density that can be achieved. In this work we analyze the crosstalk produced in sublithographic programmable logic array (PLA) architectures and propose an alternative layout scheme that reduces the effects of crosstalk in adjacent wires. The proposed methodology has an interleaved layout scheme with two non-overlapping out-of-phase clocks that prevent neighboring wires from transitioning simultaneously. Results presented in this paper indicate that this scheme provides for better tolerance against crosstalk than other structures proposed for sublithographic PLAs. The effects of different parasitics (i.e. coupling and decoupling capacitances from different parts of the crossbar segment) on the crosstalk induced are also analyzed. [C842]

#### "Repair techniques for hybrid Nano/CMOS computational architecture"

Presence of high defect rate in nanofabrics due to the inadequate fabrication processes has held back the development of emerging technology architecture. In this work, we propose two repair techniques to provide high level of defect tolerance in lookup table (LUT) based Boolean logic approach implemented in nano/CMOS. Further, we demonstrate that direct application of memory repair techniques is ineffective in dealing with high defect rate in hybrid nano/CMOS architecture. We show that the proposed techniques are capable of handling more than 20% defect rate in hybrid nano/CMOS architecture with efficient utilization of spare units. [C843]

#### "Full adder design using hybrid CMOS-SET parallel architectures"



Hybrid CMOS-SET architectures, which combine the merits of CMOS and SET (single-electron tunneling) devices, promise to be a practical implementation for nanometer-scale circuit design. In this work we propose two binary full adders using hybrid CMOS-SET parallel architectures, which take advantage of the Coulomb oscillation with SET devices in order to improve the circuit area, power consumption and temperature effect. We use the improved MIB compact models for SET devices and simulate hybrid CMOS-SET circuits in Cadence environment with all the circuit parameters specified. The results show that the designed circuits are able to work at room temperature with high current drivability and low power dissipation. [C844]

#### "On brain-inspired hierarchical network topologies"

In this paper our aim is to identify layered hierarchical generic network topologies which could closely mimic brain's connectivity. Recent analyses have compared the brain's connectivity (based both on a cortical-equivalent Rent's rule and on neurological data) with well-known network topologies used in supercomputers and massively parallel computers (using two different interpretations of Rent's rule). These have revealed that all the well-known computer network topologies fall short of being strong contenders for mimicking the brain's connectivity. That is why in this paper we perform a high-level analysis of two-layer hierarchical generic networks. The range of granularities (i.e., number of gates/cores/neurons) as well as the fan-ins and the particular combinations of the two generic networks which would make such a mimicking achievable are identified and discussed. [C845]

#### "A Nanoscale CMOS SRAM Cell for High Speed Applications"

The leakage current and process variation are drastically increased with technology scaling. In Conventional SRAM cell due to process variations, stored data can be destroyed during read operation. Therefore, leakage current of SRAM cell and stability during read operation are two important parameters in nano-scaled CMOS technology. To overcome these limitations and to increase the speed of conventional SRAMs, we have developed a read-static– noise-margin-free SRAM cell. The developed cell has six-transistors and uses two read/write-lines and two read/write-bit-lines during read/write operation. This cell retains its data with leakage current and positive feedback without refresh cycle. The leakage current of new cell is 52% smaller than a conventional six-transistor SRAM cell. Simulation results shows proposed cell has correct operation during read/write and idle modes and is 45% faster than a usual six-transistor SRAM cell. [C846]

#### "Design and Fabrication of a Novel Micro Angle Sensor"

A novel angle sensor which works based on Lorentz force and capacitors is presented. The structure consists of two bending beams and the angle will expose by displacement of the beams. The bulk micromachining technology is employed to fabricate the sensor on silicon substrate. The suggested micro angle sensor is accurate and contactless. [C847]

#### "Invited Speaker: Formally Specifying Autonomous and Agent-Based NASA Space Exploration Missions"

[Summary form only given]. NASA plans innovative and novel approaches to future (unmanned) space exploration missions. Future missions involve sending spacecraft and robots to harsh environments, where resilience is necessary for the survival of the mission. In addition, distances and communication lead times between the spacecraft and Earth, necessitate much of the mission operation being autonomous. We have been conducting research on using agent-based concepts and in developing autonomous systems based on Autonomic Computing, whereby the mission is imbued with self-management capabilities. The need for assurance that decisions, etc., taken by the mission are within the remit of the mission and will ensure its survivability is of growing importance. We describe the PAM (Prospecting Asteroid Mission) sub-mission of the ANTS (Autonomous Nano Technology Swarm) concept mission, which illustrates the issues that may potentially arise in future swarm-based missions. We describe our approach to formally specifying ANTS and other missions, as well as efforts to apply agent-oriented software engineering and formal methods in a combined framework. [C848]

#### "The Research of a Business Rule Management Method for Virtual Organization"

Presently, there are a large number of dynamic business rules that exist in the business processes of virtual organization. In this paper, we introduce using business rule approach in the business management of a virtual organization; make use of business rule engine and the corresponding business rule language customizing business rule. By separating dynamic business logic from process control structure, and describing the dynamic business logic with declarative business rules, it can produce processes that can be changed as the need arises. Accordingly an effective algorithm is proposed to streamline rule set, and to solve the business rule engine's effectiveness problem caused by logic changes of virtual organization business. [C849]



### "Wireless System for Temperature Monitoring in Oil Palm Bio-laboratory"

Malaysia is known as the main producer of palm oil in the world. In order to maintain a good quality of palm oil product, the tissue culture process that carried out in the laboratory must be maintained at certain temperature values. Temperature is one of the important parameters that could affect the oil palm growth. A good temperature monitoring environment is necessary in order to produce the good quality products. Nowadays, the wireless sensor technology has grows in many areas of research and development as an alternative for the wired connection method that have been using previously. This project described the application of the wireless devices for the purpose of temperature data collection and storage using digital computer. The information gathered is performed by using the LM35 temperature sensor. This system used the Zigbee transceivers for the communication protocol to transmit and receive the temperature data. The data is send to the computer through the interface of Universal Asynchronous Receiver/Transmitter (UART) to a personal computer (PC) via USB port. This system will help to minimize the need for wire connections, cost, power consumption and manpower to promote stable environment in order to produce good quality products. [C850]

### "The Master-Slave Control System Design and Implementation by Serial Communication"

This paper designed and implemented an intelligent control system, in the system the Host PC is mainly responsible for the real-time control of individual lower computer to complete the parameter enactment and data display, storage, printing, etc; the lower single chip is to complete data collection, transmission and other real-time control tasks. This paper also introduced the serial communication between the PC and multi-single chip, as well as researched and set the enactment upper and lower computers, and finally established a database. [C851]

### "Research on Software Design of DSP Motion Controller"

In recent years, along with the rapid development of chip technology, foreign motion controller taking DSP or FPGA as core processor has increasingly become a development trend. This paper finishes the software design of a motion controller based on DSP. The whole system software is designed modularly, including system initialization module, interrupt module, PID control algorithm module and PWM output module, etc. The modular design of software strengthens the readability of program and favors the debugging, modification and upgrade of control system. [C852]

### "Analysis of high frequency effects in the intrinsic part of nano-metre scale MOS devices in millimeter wave band"

Distributed effects may appear in active devices in mm-wave CMOS integrated design. In this paper we have analyzed the distributed effects in the intrinsic MOS transistor. Non-quasi static effect has been reviewed and its importance in mm-wave band has been demonstrated by simulations in the foundry design kit for STMicroelectronics 90nm CMOS technology. The distributed effect of MOS transistor has been analyzed and modeled and closed form equations have been derived to calculate Y parameters of the transistor, considering the distributed nature of the transistor. Analysis results are in excellent agreement with the simulation results. The results show that by using the strategy of double connection to the gate finger the distributed effects can be avoided in millimeter wave band. [C853]

### "Study on a micro-knife and its vibration signal acquisition system"

A micro-knife which is driven by two bulk PZT-4 ceramic plates works in an ultrasonic vibration mode. This length and width of the selected micro-knife are 17 mm and 10 mm respectively. We can estimate resonant frequencies in the longitudinal direction and the transverse direction, which are 227 KHz and 452 KHz. By impedance measurement, the resonance and anti-resonance frequencies of PZT-4 plates are obtained. Then we can choose proper PZT-4 plates to drive the micro-knife and observe their vibration using high-power digital microscope and a CCD device on precision optical vibration isolation platform. It was found that if the shape of the micro-knife is linear symmetrical, there is no any displacement in transverse direction, while if the shape of the micro-knife is unsymmetrical, the displacement in transverse direction will occur besides the longitudinal direction, which is consistent with the theory. At last, we studied micro-knives vibration signal acquisition system based on digital signal processing (DSP) and phase locked loop (PLL). The circuit and software of the system were developed. The vibration voltage signal result was simulated. And we can lock the vibration voltage frequency. This method can provide an effective method for accurate measurement and control of the PZT-driven micro/nano devices. [C854]



### "Preparation and characterization of Al-doped ZnO piezoelectric thin films"

Summary form only given. In this paper, the Al-doped Zinc Oxide (ZAO) thin films have been successfully spin coated on glass substrate by using the sol-gel method. The X-ray diffraction (XRD) analysis is used to characterize their orientation and crystalline quality, and SEM is used to study the morphologies of ZAO thin films. The influence of different heat treatment temperatures on the crystalline quality and the surface morphology are also investigated. Moreover, the effect of annealing temperatures to the transmission spectrum of the thin films is studied by using the UV-visible spectrophotometer. The results show that the crystal orientation of ZAO thin films with heat treatment at 100°C and annealing treatment at 600°C are the appropriate parameters for using the sol-gel method to prepare ZAO thin film. The ZAO thin films with a glass slide substrate prepared by our developed method can be applied as transparent electrode. [C855]

### "Nonlinear modeling of piezoelectric actuator based on SVR"

The establishment of non-linear model of piezoelectric actuator is a key link of the nano-scale micro-displacement measurement and control. Due to the inherent nonlinearity and the influence of load pressure, piezoelectric actuator always causes position error in the open-loop system and instability in the closed-loop system. Based on the experiment of creep characteristics, the effect of driven voltage and load pressure on piezoelectric actuator output displacement has been researched in this paper. A non-linear model of piezoelectric actuator using orthogonal test and support vector regression (SVR) has been set up. And modeling experiments have been carried out. The experiments show that the predicted values agree well with the experimental results. The process of modeling is explicit, and the computation is simple. [C856]

### "Electrical characterization of resistive memory in metal-Pr<sub>0.7</sub>Ca<sub>0.3</sub>MnO<sub>3</sub> interface: A future non-volatile memory device"

The phenomenon of electric pulse induced resistive switching in metal (Ag)-oxide (Pr<sub>0.7</sub>Ca<sub>0.3</sub>MnO<sub>3</sub>) interface has been studied in detail. Dielectric spectroscopy (frequency range ~ 10 Hz-10 Mz) has been used to investigate the formation of switched interface and underlying mesostructure. Resistance switch has been realized only over a voltage threshold (V<sub>Th</sub>) and a very fast 'write' speed (~100 ns or less) with excellent reversibility has been achieved. Detailed kinetics and relaxation studies are conducted with data retention time period of more than 10<sup>8</sup>sec (~years). Based on the above results, a defect creation/annihilation and lattice rearrangement model for switching has been developed. C-AFM (conductive AFM) has been used to study the nano inhomogeneity of the conductivity of metal-PCMO interface and a more complex percolation model has been outlined. [C857]

### "The role of ballistic mobility and saturation velocity in performance evaluation of a nano-CMOS circuit"

The mobility and saturation velocity are the two important parameters that control the charge transport in a channel. The mobility is ballistic as channel length is scaled down to length smaller than the mean free path of carriers in the channel. It is found that the ballistic saturation velocity does not sensitively depend upon low-field mobility or scattering interactions. In an infinite electric field and in the absence of quantum emission, the saturation velocity is limited to the thermal velocity in the nondegenerate realm and Fermi velocity in the degenerate realm. It may be lowered by the emission of a quantum. However, the drain electric field is always finite and hence the drain velocity is always smaller than the saturation velocity at the onset of quasi current saturation. Expressions for voltage V<sub>Dsat</sub> and current I<sub>Dsat</sub> at the onset of current saturation transform dramatically in a nanoscale circuit. The modeling applied to 80-nm and 45-nm CMOS processes give exceedingly good comparison to the experimental data. [C858]

### "Characterization of on-wafer RF passive components for RFIC devices using three-steps de-embedding method"

This paper demonstrates the process of characterizing on-wafer RF components for RFIC devices by using a three-steps de-embedding method. Three RF passive components are used for this purpose: spiral inductor, metal-finger capacitor and silicide-block N-poly resistor. The DUTs together with their calibration structure was fabricated in 0.13 μm CMOS technology. Comparisons between the simulated data, raw measured data and de-embedded data were made in order to see the accuracy of the de-embedding method. [C859]

### "A variable gain, 2.5 GHz CMOS low-noise amplifier for mobile wireless communications"

A two-stage, variable-gain low-noise amplifier (LNA) which offers good matching and good noise performance is demonstrated. A prototype 2.5 GHz LNA is designed and simulated using 0.13 μm RF CMOS process



technology. The simulated LNA has a maximum gain of 32.6 dB, input return loss of -44.9 dB, and output return loss of -5 dB. It has a noise figure of 1 dB and input P1dB of -33.9 dBm in high-gain mode, and noise figure of 2.6 dB and input P1dB of -14.6 dBm in low-gain (15.4 dB) mode. The complete device draws 20.3 mA of current from a 1.2 V supply for a total power consumption of 24.4 mW. [C860]

#### "Design and development of megasonic system and its application to PZT nano powder dispersion"

Although ultrasonic cavitation provides various applications for ultrasound, its inherent disadvantages can not be neglected. In ultrasonic dispersion process, ultrasound, in a frequency of 20 to 80 kHz, causes damages to materials due to excessive cavitation and inferior self-guidance. In order to alleviate cavitation and help the acoustic field focus, a novel megasonic implementing system has been designed and developed. It consists of a megasonic transducer and a Mega-Hertz power supply. The transducer is constructed in the form of cylindrical tube with a round piece of PZT-8 piezoelectric ceramic. The power supply provides sinusoidal voltage and current outputs at oscillating frequency ranging from 630 kHz to 650 kHz. The transducer consumes an electrical power of over 400W. The acoustic pressure is measured within the range of 2.86 MPa to 8.92 MPa by a PVDF sensor. Experimental results of Megasonic dispersion of PZT nano powder manifest the conglomeration prevention effect, which is characterized by Thermal Field Emission SEM (TFE-SEM), Transmission Electron Microscopy (TEM), and the stable constitution of PZT nano particle through treatment, which is confirmed by X-Ray Diffraction (XRD). [C861]

#### "LUT-Based QCA Implementation of a 444 S-Box"

Quantum Cellular Automata (QCA) represents an emerging technology at the nanotechnology level. Nowadays, many applications of QCA technology are introduced and cryptography can be an interesting application of QCA technology. Substitution boxes are important components in many modern day block and stream ciphers. Therefore, we have implemented a 444 S-Box using QCA technology. Simulation results are obtained from QCADesigner software. [C862]

#### "Single Electron Fault in QCA Inverter Gate"

Quantum Cellular Automata (QCA) represents an emerging technology at the nanotechnology level. There are various faults which may occur in QCA cells. One of these faults is the Single Electron Fault (SEF) that can happen during manufacturing or operation of QCA circuits. A detailed simulation based logic level modeling of Single Electron Fault for QCA Inverter gate is represented in this paper. [C863]

#### "Applications of Carbon nanotube technology for next-generation high speed and microwave circuits"

Carbon nanotubes (CNTs) have demonstrated promising electrical, thermal, and mechanical properties. For example, CNTs have long mean free paths in the order of several micrometers (as compared to 40 nm for Cu at room temperature), resulting in low resistivity and possible ballistic transport, and an isolated CNT can carry current densities in excess of 10<sup>10</sup>A/cm<sup>2</sup> even at an elevated temperature of 250 °C. These unique properties make them exciting prospects for a variety of applications in microelectronics/nanoelectronics, spintronics, optics, as well as material science, mechanical and biological fields, and even fundamental areas like relativistic quantum mechanics and condensed matter physics. This paper reviews the current state of research (including some research achievements of the author's group) in applications of Carbon nanotube technology for high speed and microwave circuits. At first both electrical and thermal modeling and broadband characterization for various CNTs (single walled CNTs, multi walled CNTs and CNT bundles) are presented and compared each other and with conventional conductor materials to give guidelines for their prospective applications. Then various applications, including for high speed interconnects and vias, microwave passives such as inductors, capacitors, resonators, antennas, and some other fields, are introduced and discussed. The results from simulation or experiment show that some performance, such as the delay of interconnect and quality factor of microwave inductor, of interconnects or microwave passives based on CNTs is much better than that based on traditional conductors, indicating that the emerging nano-scale materials have great potential in applications for next-generation high speed and microwave circuits. [C864]

#### "Logic-based QCA implementation of a 444 S-Box"

Quantum Cellular Automata (QCA) represents an emerging technology at the nano technology level. Nowadays, many applications of QCA technology are introduced and cryptography can be an interesting application of QCA technology. Substitution boxes are important components in many modern day block and stream ciphers. Here, we have implemented a specific 444 S-Box using QCA technology. Simulation results are obtained from QCADesigner software. [C865]



### "Development of nano-metallic catalysts for the single-use, disposable biomedical sensor platform technology"

Single use, disposable biosensors for the in vitro detection of biomarkers are important for home care, point-of-care and early stage diagnosis applications. The sensitivity and the repeatability of the biosensor outputs are important, and minimum interference by other components in the test medium is also essential. Enzymatic reactions of the biomarkers producing an electrochemically active species, such as H<sub>2</sub>O<sub>2</sub> and NADH, are often used as a means for the detection of the biomarkers. Nanoparticle metallic catalyst appears to provide enhanced performance of various biosensors. Experimental assessments of many biomarkers, such as glucose, ketone (3 $\beta$ -hydroxybutyrate), total bile acid and others using the nano-particle metallic catalyst have been undertaken. It is also shown that bi-metallic nanoparticles can further enhance the performance of the biosensor. Methods of preparing and testing these of nano-particles will be discussed. [C866]

### "Modeling and analysis of Nano enable solar and fuel cell systems"

In this paper the modeling aspects of some proposals of MEMS elements of fuel cells are explained. The necessity of a nonporous membrane, MEMS based pumps, anodes etc. has been eminent in recent fuel cells. The need for MEMS based models for porous silicon based membranes based on nano imprints technology has been met by modeling it in SUGAR in MATLAB environment. We have identified and categorized the domains of Nano enabled solar cells and have put forth a proposition for multi scale modeling of Solar cells. Multi scale modeling on HPC (High performance computing) of a Nano enabled solar cell is shown under MCCS (Microsoft compute cluster environment) environment using extreme optimization numerical library. Distribution and performance analysis of four levels of computation in a multi scale model is implemented with the distribution being carried out from classical semi-conductor to quantum levels as to accurately predict the behavior and properties of the solar cell. [C867]

### "Ocimum Mediated Biosynthesis of Silver Nanoparticles"

Currently the need for various developmental models in material sciences to develop green technologies has been reemphasized. For biodiversity rich countries like India, low investment and sustainability of biological synthesis adds to its attraction. Plants respond to heavy metal stress by metal complexation process like production of phytochelations or by other metal chelating peptides. In this paper we report the synthesis of AgNPS from the room dried stem and root of Ocimum sanctum at room temperature. The reaction process was simple for formation of highly stable silver nanoparticles. The morphology and crystalline phase of the NPs were determined from transmission electron microscopy (TEM), selected area electron diffraction (SAED) and X-ray diffraction (XRD) spectra. Transmission Electron Microscopy studies showed that the average silver nanoparticles obtained from roots and stem were of sizes  $10 \pm 2$  nm and  $5 \pm 1.5$  nm respectively. [C868]

### "Application of RFID Technology in Heat Meters"

The application of RFID technology in heat meters is presented in this paper. Heat meters are terminal equipment in heat supply management system. By use of RFID technology in heat meters, the data can be exchanged between heat meters and heat supplying department by RF cards. The information can be transmitted in a non-contact way. In this way, the purpose of automatic identification can be achieved. A diagram and specific design method of heat meters based on RFID are also shown in the paper. By the proof of testing and practical application, it can be seen that the new type of heat meters can meet the demands of users. Compared with the ordinary heat meters, the new type of heat meters have the advantages of small in meter volume, high accuracy, no impact of water quality, good reliability and so on. This provides a firm material foundation for management information and intelligent management in heat metering. [C869]

### "Computational Experience with Nano-material Science Quantum Monte Carlo Modeling on BlueGene/L"

Modeling and simulation are necessary for nano-material science, as experiments and appliances are costly. In this work we introduce a typical tool flow used for computational nano-material science and report our computational experience with it. QWalk is a Quantum Monte Carlo simulation tool; one of the main methods in identifying nano-material properties, such as the total energy and the band structure of the material. We explain the tool flow for nano-materials and use QWalk to estimate the total energy of selected molecules. We study the tool's use for modeling of molecules at the nano level using three selected molecules and give our experience with QWalk's scalability and the underlying factors affecting it. We discuss the tool's performance, make our recommendations and try to explain some observations. [C870]



### "Smart Integrated Sensors in Real Time Monitoring Critical Parameters in Tissue Culture Growth Room of Oil Palm"

Real-time monitoring critical parameters can be enhanced by extending the alert system via email and short messaging system (SMS) technology. The aim of the smart integrated sensors is to remotely monitor critical parameter in tissue culture growth room. The tissue culture laboratory provides the oil palm industry with innovations for the production of improved planting materials and information on the molecular biology of tissue culture processes. Research has shown that factors such as temperature, humidity, liquid, phase and gas compositions are critical in producing quality clonal materials using tissue culture process. Therefore, it is necessary to provide good physical and chemical conditions for production of quality products. Consequently, sensors are required to monitor and record the data in growth room. SHT11 sensors are used to monitor parameters of temperature and humidity along with an optical sensor system for liquid phase and composition monitoring. In support to monitor gaseous in the vessels, sensors of oxygen, carbon dioxide and ethylene are utilized in the tissue culture growth room. Thus, a smart integrated sensors system is developed to monitor all influenced parameters in the culture growth room linked to the database and analysis software. [C871]

### "Offline Analysis of High Frequency Digital Signal"

This project highlights the significant of the high frequency (HF) communication systems in the field of communications. With a frequency spectrum between 3 MHz to 30 MHz an ionosphere reflects this signal frequency range very well. Hence, the HF communication can be applied well in long distance transmission. HF communication is currently applied in radio communications, but applications are still limited due to noise, limiting its usefulness. Taking these factors into consideration, the idea is to enhance this application technology. For this to work, an application system to analysis HF signal is developed. The system is capable of analyzing and improving the quality of HF signal. The system is operated in offline mode. Using the periodogram and spectrogram technique, the signal can be analyzed. Signal information such as frequency, energy and the duration can then be determined. In addition, the modulation type of the signal and the bit rate can also be determined. The Graphic User Interface (GUI) of the system is developed for end-user ease of use. [C872]

### "Characterization and Tolerance of QCA Full Adder under Missing Cells Defects"

Quantum-dot Cellular Automata (QCA) is a promising nanotechnology that offers significant improvement over CMOS. QCA is limited by the high fault rate in manufacturing. In this paper, a novel QCA adder structure is presented which is more robust in compare with previous reported designs. Different types of defects in this technology are presented. The full adder is simulated under missing cell defects and its effects in outputs are investigated. It shows that there are some sensitive points in this circuit under missing cell defects. Some solutions for increasing the fault tolerance of the circuit under this specified defects is presented. [C873]

### "3D Simulation for Vehicle Maneuvering along Path Accurately"

Aiming at the simulation problem of vehicle maneuvering along path accurately, simulation framework including motion control module, viewpoint control module, collision detection module, path-maneuver module and special effect module is firstly presented according its simulation functions and characteristics. Secondly, key technologies involving terrain model optimization, large area database management and maneuvering along path are put forward. Road network data organization, path matching and path building of maneuvering along path are detailed. Finally, simulation examples based on the platform combining Multigen Creator and Vega Prime are brought forward. It shows greatest traits on building similar large-scale simulation application system. [C874]

### "Performance of Different Types of Array Structures Based on Multiple Signal Classification (MUSIC) Algorithm"

Smart antenna systems are rapidly emerging as one of the key technologies that can enhance overall wireless communications system performance. By making use of the spatial dimension, and dynamically generating adaptive receive and transmit antenna patterns, a smart antenna can greatly reduce interference, increase the system capacity, increase power efficiency as well as reduce overall infrastructure costs. Here, the performance of smart antennas with uniform linear arrays (ULA), uniform circular arrays (UCA) and uniform rectangular arrays (URA) is examined and compared using MUSIC algorithm. [C875]

### "3D 65nm CMOS with 320°C microwave dopant activation"

For the first time, CMOS TFTs of 65 nm channel length have been demonstrated by using a novel microwave dopant activation technique. A low temperature microwave anneal is demonstrated and discussed in this study.



We have successfully activated the poly-Si gate electrode and source/drain junctions, BF<sub>2</sub> for p-MOS TFTs and P<sub>31</sub> for n-MOS TFTs at a low temperature of 320 °C without diffusion. The technology is promising for high performance and low cost upper layer nanometer-scale transistors as required by low temperature 3D-ICs fabrication. [C876]

#### "A compact threshold voltage model for narrow channel nano-scale MOSFETs"

This paper presents a compact threshold voltage model for narrow channel MOSFETs for the purpose of VLSI circuit simulation. A nano-scale trench isolated MOSFET has been considered whose gate length and width are in the sub 65 nm regime. The developed model has been validated by comparing the results predicted from the derived model with those obtained using the device simulator of TCAD Sentaurus. [C877]

#### "Nanosilicon photonics"

Silicon photonics is no more an emerging field of research and technology but a present reality with commercial products available on the market, where low dimensional silicon (nanosilicon or nano-Si) can play a fundamental role. After a review of the field, the optical properties of silicon reduced to nanometric dimensions are introduced. The use of nano-Si, in the form of Si nanocrystals, in the main building blocks of silicon photonics (waveguides, modulators, sources and detectors) is reviewed and discussed. Recent advances of nano-Si devices such as waveguides, optical resonators (linear, rings and disks) are treated. Large emphasis is dedicated to the visible optical gain properties of nano-Si and to the sensitization effect on Er ions to achieve infrared light amplifications. The possibility of electrical injection in the light emitting diodes is presented as well as the recent development addressed to exploit nano-Si for solar cells. In addition, nonlinear optical effects which will enable fast all-optical switches are described. [C878]

#### "A novel approach of And-Or-Inverter (AOI) gate design for QCA"

Quantum dot cellular automata (QCA) define the nano structure of a basic computer. It is used as an alternative for designing high-speed computer over CMOS technology. The basic logic in QCA is the logic state that does not measure with voltage level; rather it measures the polarity of electrons in cell. The Majority Voter (MV) is first introduced to design the logic circuits, but only using MV, designing complex logic circuit became inefficient. Many proposals had been made for designing QCA logic gate. In this paper we focus on Novel nanostructure, reduced size and efficient design of  $\Gamma$ , Bi And-Or-Inverter  $\Gamma$ , Bi (AOI) and also present comparison with previously reported AOI gate. We design New AOI gate using a combination of Nand-Nor-Inverter (NNI) and MV. Simulation result shows almost 54% reductions in size of AOI gate and improving gate delay due to less complexity on compare to early report. We analyze QCA defect on proposed AOI gate and describe its permissible defect tolerance. We also describe NNI with its QCA nano structure. [C879]

#### "Asynchronous logic for high variability nano-CMOS"

At the nanoscale level, parameter variations in fabricated devices cause extreme variability in delay. Delay variations are also the main issue in subthreshold operation. Consequently, asynchronous logic seems an ideal, and probably unavoidable choice, for the design of digital circuits in nano CMOS or other emerging technologies. This paper examines the robustness of one particular asynchronous logic: quasi-delay insensitive or QDI. We identify the three components of this logic that can be affected by extreme variability: staticizer, isochronic fork, and rings. We show that staticizers can be eliminated, and isochronic forks and rings can be made arbitrarily robust to timing variations. [C880]

#### "Online multiple error detection in crossbar nano-architectures"

Crossbar nano-architectures based on self-assembled nano-structures are promising alternatives for current CMOS technology, which is facing serious challenges for further down-scaling. One of the major challenges in this nanotechnology is elevated failure rate due to atomic device sizes and inherent lack of control in self-assembly fabrication. Therefore, high permanent and transient failure rates lead to multiple faults during lifetime operation of crossbar nano architectures. In this paper, we present a concurrent multiple error detection scheme for multistage crossbar nano-architectures based on dual-rail implementations of logic functions. We prove the detectability of all single faults as well as most classes of multiple faults in this scheme. Based on statistical multiple fault injection, we compare the proposed technique with other online error detection and masking techniques such as Triple Module Redundancy (TMR), duplication, and parity checking, in terms of fault coverage as well as area and delay overhead. [C881]

#### "Design challenges in nanometric embedded memories"



Embedded memories comprise over half the die area in modern SOC ICs. These circuits enable large gains in performance, however they bring with them many challenges. As CMOS technology scales deep into the nanometric region the size and density of embedded memories are increasing, both of which result in increased challenges for designers. This paper describes the design challenges intrinsic to the implementation of embedded memories in modern nanometric CMOS processes. [C882]

#### "Analysis and modeling of space radiation effects in quantum dot based nanomaterials for high-efficiency photovoltaic cells"

For applications in satellite systems, devices based on novel nanomaterials offer significant advantages over traditional technologies in terms of light-weight and efficiency. Examples of such novel devices include quantum dot (QD) based solar cells and photodetectors. However, the response of these devices to radiation effects is not well understood, and radiation effects modeling tools are not yet available. In this paper we review our numerical models and experimental investigation of radiation effects in quantum dot based solar cells. In the natural, high-radiation environment of space all solar cells suffer from degradation. Although some studies have been conducted, and test data collected, on the performance of solar cells in a radiation environment, the mechanisms of radiation-induced degradation of quantum dot superlattices (QDS) has yet to be established. We have conducted proton irradiation experiments to provide a direct comparison of radiation hardness of quantum dot based cells and regular solar cells. An approach to the development of Nano-scale Technology Computer Aided Design (NanoTCAD) simulation software for simulation of radiation effects in QDS-based photovoltaic (PV) devices is presented. The NanoTCAD tools are based on classical drift-diffusion and quantum-mechanical models for the simulation of QD PV cells. [C883]

#### "Enhanced spontaneous emission of electric dipole by nano-optical antenna"

We study the characteristics of nano-optical antenna made of two gold nano-particles by three dimensional numerical calculations at visible and near infrared band. To carry the computational burden and guarantee the precision and speed of a 3D FDTD calculation, adaptive mesh refinement technology is used. We first highlight the concrete way of controlling over the emitter position to fulfill the requirements of larger spontaneous emission enhancement. By exciting the resonance of surface plasmon polaritons (SPPs), we find that the far field directivity is strongly influenced and obtain around 5000-fold spontaneous emission enhancement. Choosing the incident wavelength of 600nm, we compute the decay rates and radiant efficiency as a function of antenna geometry limitations, showing the particle with an aspect ratio of  $L/R=4$  is best for enhancing spontaneous emission. Furthermore, we proceed a spectrum analysis and find an exact relationship between the particle length and resonant wavelength. [C884]

#### "Design, fabrication, and preliminary test of multi-layers nano resonant tunneling film gyroscope"

A novel structure MEMS gyroscope using the multi-layers nano resonant tunneling film with meso-piezoresistive effect is introduced in this paper. According to the theory of drive and detection, the folding-type orthogonal beam structure is designed, and the simulation of ANSYS proves that the structure does not only meet the drive approach, but also meets the detection conditions. This kind of gyroscope has been fabricated by GaAs IC surface processes and control hole etching technology. The Wheatstone bridge circuit with negative differential resistance of RTD is established to detect the change of stress at the base of detection beam. According to the experiment results, the I-V characteristics of RTDs are changed obviously in the role of stress, and prove that the detection beam based on RTD is feasible. [C885]

#### "Recent advances in biomagnetics and bioimaging for brain research and sensing technologies"

Biomagnetics is an interdisciplinary field where magnetics, biology and medicine overlap. Recent advances in biomagnetics have enabled us not only to detect extremely weak magnetic fields from the human brain but also to control cell orientation and cell growth by using extremely high magnetic fields. Pulsed magnetic fields are also routinely used nowadays for the magnetic stimulation of the human brain, and both high frequency magnetic fields and magnetic nano-particles have promising therapeutic and diagnostic applications. Here we will also show how highly sensitive superconducting magnetometers have shown great potential for high resolution magneto-encephalography. On the imaging front, magnetic resonance imaging (MRI) is now a powerful tool for basic and clinical medicine. New methods of MRI based on the imaging of impedance of the human body, called impedance MRI, and the imaging of neuronal current activities in the human brain, called current MRI, are also being developed. [C886]

#### "Design in the nano-scale Era: Low-power, reliability, and error resiliency"

Scaling of technology over the last few decades has produced an exponential growth in computing power of



integrated circuits and an unprecedented number of transistors integrated into a single chip. However, scaling is facing several problems-severe short channel effects, exponential increase in leakage current, increased process parameter variations, and new reliability concerns. We believe that device aware circuit and architecture design along with statistical design techniques can provide large improvement in power dissipation (Vdd scaling) while providing the required reliability and yield. In this talk I will present design techniques to address power and reliability problems in scaled technologies for both logic and memories. [C887]

#### "Carbon nanotube based electrochemical immunosensors for high-sensitive detection of E. coli"

This paper outlines the fabrication and characterization of an immunosensor based on electrochemical, biological, and nano-material techniques to achieve high sensitive detection of Escherichia coli (E.coli). The working electrode consists of E.coli antibody/antigen/horse-radish peroxidase (HRP) labeled antibody immobilized on plasma-functionalized multiwalled carbon nanotube (pf-MWCNT) film. Immunosensors were characterized by cyclic voltammetry using 10 mM K<sub>3</sub>Fe(CN)<sub>6</sub>/3 M KCl and 3, 3', 5, 5'-tetramethylbenzidine (TMB). This immunosensor shows very high sensitivity to E. coli O157:H7 and detection limit as low as 0.031 ng/ml. This is 100 times lower than that achievable with standard spectrophotometric enzyme-linked immunosorbent assay (ELISA) using the same immunochemicals. [C888]

#### "H $\infty$ controller design for high-performance scanning tunneling microscope"

Ultrahigh positioning accuracy with high bandwidths are the great challenges in the field of nano-positioning and scanning systems. This article talks about the controller design for a closed-loop scanning tunneling microscope to deal with such challenges, considering fast continuous variations in sample surface with the presence of noise in the loop. The desired performances in vertical Z-direction of the scanner are imposed on the closed-loop sensitivity functions using appropriate weighting functions and then a mixed-sensitivity H $\infty$ B $\infty$ controller is designed. The results are compared with the conventional proportional-integral control design commonly used by the scanning probe community, underlining the improvements obtained in terms of high precision with high bandwidth. [C889]

#### "Towards STEM control: Modeling framework and development of a sensor for defocus control"

Scanning transmission electron microscopes are indispensable tools for material science research, since they can reveal the internal structure of a wide range of specimens. Thus, it is of scientific and industrial interest to transform these microscopes into flexible, high-throughput, unsupervised, nano-measuring tools. To do so, processes that are currently executed manually based on visual feedback (e.g., alignment or particle measurement) should be automated, taking into consideration their time dependencies. That is, these microscopes should be studied from the systems and control perspective. To the best of our knowledge, such perspective is lacking in the literature. Thus, it is provided here through a new modeling framework that facilitates the future development of control strategies based on image analysis. The progress made towards developing an image-based sensor for defocus control is also reported. Finally, the paper also aims to introduce scanning transmission electron microscopy as an important and untapped application area for control engineers. [C890]

#### "Model predictive control of linear periodic systems-a unified framework including control of multirate and multiplexed systems"

State-feedback model predictive control (MPC) of discrete-time linear periodic systems with possibly time-dependent state and control input dimension is considered. States and inputs are subject to hard, mixed, polytopic constraints. It is described how discrete-time linear systems, both time-invariant and periodic, with multirate or multiplexed control inputs can be modeled as such periodic systems. This makes linear periodic systems with possibly time-dependent dimensions a unified, coherent and succinct state-space modeling framework for a large variety of control problem for linear plants, periodic or non. In this paper it is shown how important theoretical results for state-feedback MPC of constrained linear time-invariant (LTI) systems are conceptually equivalent to what is required for linear periodic systems. Specifically the determination of (maximum) periodic controlled and positively invariant sets and the solution of reverse periodic discrete-time algebraic Riccati equations are considered indispensable. A general definition, and a method for the determination, of maximum periodic controlled and positively invariant sets are proposed here. Thus least-restrictive, strongly feasible MPC problems resulting in infinite-horizon optimal state-feedback control laws are designed. The proposed methods are applied to a multirate twin-actuator nano-positioning system. [C891]

#### "X-ray computed tomography on miniaturized solder joints for nano packaging"



The challenge of nano packaging requires new nondestructive evaluation (NDE) techniques to detect and characterize very small defects like transportation phenomenon, Kirkendall voids or micro cracks. Imaging technologies with resolutions in the sub-micron range are the desire. But what does nano packaging mean? High end semiconductor industries today deal with functional structures down to 45 nm and below. ITRS roadmap predicts an ongoing decrease of the ?DRAM half pitch? over the next decade. Nano packaging of course is not intended to realize pitches at the nanometer scale, but has to face the challenges of integrating such semiconductor devices with smallest pitch and high pin counts into systems. System integration (SiP, SoP, Hetero System Integration etc.) into the third dimension is the only way to reduce the gap between semiconductor level and packaging level interconnection. The task is not only to identify any impurities on the package surface, but also to look as deep as possible into the package volume. Available non-destructive evaluation (NDE) methods for such kind of packaging are for example X-ray microscopy, X-ray computed tomography, ultrasonic microscopy and thermal microscopy. An overview was presented in. To investigate and discuss the limitations of the current NDE techniques and to find new ways to solve these problems the German government (Federal Ministry of Education and Research-BMBF) supports the research project ?Destructive and non-destructive evaluation techniques to characterize nano-scaled defects in highly miniaturized solder joints - nanoPAL?. The Electronics Packaging Lab and the Center of Microtechnical Manufacturing are the responsible institutions for the non-destructive testing part in this public project and main parts of the content of our presentation are results of this work focused on X-ray nano focus microscopy and nano focus computed tomography. This paper discusses the potentials and the limits of X-ray NDE techniques-, illustrated by crack observation in solder joints, evaluation of micro vias in PCBs and interposers and the investigation of soldering quality of BGAs. The paper presents tomography results with voxel sizes (voxel: smallest gray scale unit / pixel with third dimension (cube)) less than 900nm and gives some information about the practical use of a computed tomography system. [C892]

#### "Dynamic visualizations of flow and meniscus for quadrilateral bump arrangement in capillary underfill process"

This study has investigated the dynamic variations of flow and meniscus during underfill process using flow visualization technique to understand physics of underfill flows. As a quantitative flow visualization technique,  $\Gamma$ ,Bi-PIV(micro particle image velocimetry) was applied. Glycerin was filled into a glass chip which has quadrilateral bump arrangement. It was found that the wetting distance increases rapidly when the meniscus attaches onto the bump and it increases slowly when the meniscus detaches from the bump. The contact angle and the meniscus velocity are in-phase according to the meniscus position. The flow velocity is the fastest between bumps when the meniscus is detached and then the flow velocity continuously gets slow down. [C893]

#### "Effect of strain rate and temperature on tensile flow behavior of SnAgCu nanocomposite solders"

The tensile flow behavior of Sn-3.8Ag-0.7Cu (SAC387) nanocomposite solders have been studied with strain rates ranging from 10<sup>-5</sup> to 10<sup>-1</sup>s<sup>-1</sup> and at temperature of 25, 75 and 125 $\Gamma$ ,B°C. The flow stress and the Hollomon parameters were observed to increase substantially with increasing strain rate. The strain hardening exponent increased substantially with increasing strain rate and decreasing with temperature for all the composite solders investigated. The strain rate dependence of strain hardening exponent was stronger at higher temperatures for SAC387 solder alloy, while it is weaker for composite solders reinforced with nano sized Mo particles. The strain hardening exponent was found to be less sensitive to temperature at higher strain rates. The fractographic features of ambient and elevated temperature tensile fracture surfaces of the nanocomposite solders deformed at various strain rates are discussed. [C894]

#### "Compact nanoplasmonic Mach-Zehnder interferometers"

We present a novel design of two nano-scale plasmonic devices: a 2 $\Gamma$ fB—2 directional coupler switch and a Mach-Zehnder interferometer. The overall efficiency was 37% for the former one and 70% for the latter one. [C895]

#### "Silicon photonics technologies for monolithic electronic-photonic integrated circuit (EPIC) applications: Current progress and future outlook"

Research into the limits of electrical interconnects indicates that metal wire is unlikely to be the ultimate solution to support the growing functionalities of next generation microprocessor. Severe information latency and power consumption are key technological challenges facing the traditional copper interconnects which impose tremendous constraints to keep up with the performance roadmap known as Moore's Law. The shift of paradigm in computer architecture that enables significant parallelism based on a radically new communication landscape will be a remarkable breakthrough. Converging electronic and photonic integrated circuits (EPIC) on a single chip



platform to enable functional diversification emerges as one promising approach which could be realized by taking the advantage of low energy and huge data capacity of optical interconnects. By leveraging on the wealth of CMOS technology know-how and infrastructures, the fundamental photonics building blocks that are essential for the demonstration of low-cost EPIC platform have been successfully developed in this work. We present an overview on the current status of this critical technology development and provide an outlook for the monolithic integration of Si micro- and nano-photonics. A seamless integration of EPIC is poised to become a promising technology to meet the bandwidth and energy requirements of data communication in future technology nodes.

[C896]

#### **"A novel flash-ion-sensitive field-effect transistor (FISFET) with HfO<sub>2</sub>/Gd<sub>2</sub>O<sub>3</sub> (Gd) nano-crystal/SiO<sub>2</sub> sensing membranes under super nernstian phenomenon for pH and urea detection"**

An enhanced hydrogen and urea biosensor based on a novel flash-ion-sensitive field-effect transistor (FISFET) with HfO<sub>2</sub>/Gd<sub>2</sub>O<sub>3</sub>(Gd) nano-crystal/SiO<sub>2</sub>sensing membrane is demonstrated experimentally. The super Nernstian phenomenon of hydrogen detection (~80 mV/pH) is achieved according to the charge trapping effect. The performance of reliability including long-term stability and endurance are systematic studied. For urea detection, the higher sensitivity is obtained (~20 mV/mM) in the concentration range from 1 to 8 mM. [C897]

#### **"New frontiers in nano-scale highly nonlinear photonic circuits for System on System (SoS) Integration"**

Advances in system on chip (SoC) and system in package (SiP) that draw upon experiences gained from nano, bio and photon based technologies have created a new domain that permits fabrication of multiplicity of independent technologies as part of 3D hyper-integrated system on system (SoS) platform. Recent advances in nonlinear optics supported by fabrication and experimental work on the extreme nonlinear optical behavior of nano-scale waveguides with high linear and nonlinear index materials has opened new horizons for chip-size photonics devices. These devices can be incorporated within SoC and SoS configurations as part of the optical layer, providing an ideal platform for fabrication of compact all-in-one optoelectronic devices within the 3D multi-layered SoS technology. [C898]

#### **"Effect of bonding and aging temperatures on bond strengths of Cu with 75Sn25In solders"**

In the present study, the interaction between thin film Cu and non-eutectic Sn-In is studied. The effects of the bonding and aging temperature on microstructure, IMC formation and also shear strength are investigated by SEM/EDX, XRD and shear testing. The bonding mechanism is proposed based on the obtained results. The bonding mechanism is proposed to occur over 2 stages: (1) An increase in bonding temperatures leads to an increase in the true contact area, and (2) The aging temperature leads to interdiffusion and assists formation of the IMC. The type of IMC that forms is  $\Gamma_2$  phase (Cu<sub>6</sub>(Sn, In)<sub>5</sub>) which is similar to the interaction between Cu and eutectic Sn-In. The shear strength increases with increasing the bonding temperature. On the other hand, the aging temperature does not have a significant impact on the shear strength. This indicates that the shear strength is mostly affected by the true contact area rather than the IMC formation. [C899]

#### **"Electro-mechanical evaluation of Ag trace patterns by ink-jet printing"**

Ink-jet printing is a novel method to promote electrical circuit by printing metal nanoparticles onto flexible substrates. This novel method allows to develop sensor that can be used to measure deformation, and also to measure the life cycle of a material. The conductive ink printed directly onto flexible surface allows to evaluate the behaviour of the substrate material under mechanical solicitation. The present work aims to evaluate electro-mechanically the conductive trace obtained by silver nano-particles. The trace consists of a line of 25 mm equivalent to one grid of a printed strain gauge. The amount of layer and the width of the trace was evaluated in order to selected the best set-up, in which is the sample that have low level of roughness and satisfactory reproducibility of the electrical resistance. Cyclic bending fatigue test were carried out on selected samples with two different displacement applied. Ag printed trace submitted to 4 of mm displacement presented life cycle 50% less than displacement of 2 mm. [C900]

#### **"A proposal of a method to analyze 3D deformation / fracture characteristics inside materials based on a stratified matching approach"**

In the past, deformation / fracture (D/F) characteristics, defined as load-deformation relationships until the materials are fractured, have been analyzed and evaluated on the surface from milli- to micro-scale. The D/F characteristics are affected by more than ten thousand micro-scale internal structures like air bubbles (pores), impurity particles and cracks in 1 mm<sup>3</sup>; therefore, it is required to analyze nano-scale D/F characteristics inside



materials. In this paper, we propose an analysis method by obtaining displacement vectors of impurity particles from nano-order 3D-CT images. A problem of matching over ten thousand impurity particles between deformation is solved by a stratified matching. [C901]

#### **"Analysis of single-event effects in embedded processors for non-uniform fault tolerant design"**

Advances in silicon technology and shrinking the feature size to nanometer scale make unreliability of nano devices the most important concern of fault-tolerant designs. Design of reliable and fault-tolerant embedded processors is mostly based on developing techniques that compensate adding hardware or software redundancy. The recently-proposed redundancy techniques are generally applied uniformly to a system and lead to inefficiencies in terms of performance, power, and area. Non-uniform redundancy requires a quantitative analysis of the system behavior encountering transient faults. In this paper, we introduce a custom fault injection framework that helps to locate the most vulnerable nodes and components of embedded processors. Our framework is based on an exhaustive transient fault injection to candidate nodes which are selected from a user-defined list. Furthermore, the list of nodes containing the microarchitectural state is also defined by user to validate execution of instructions. Based on the reported results, the most vulnerable nodes, components, and instructions are found and could be used for an effective non-uniform fault-tolerant redundancy technique. [C902]

#### **"Interfacial reaction and dissolution behavior of Cu substrate in molten Sn-3.8Ag-0.7Cu-nano Mo composite solder"**

In electronic packaging, solder alloy is used to connect the electronic devices on the copper pad to switch on the functionality of those devices. When solid copper comes in contact with a liquid solder alloy, reaction takes place and intermetallic compound (IMC) layer forms at the solid-liquid interface. To reduce the diffusion of the substrate, the major issue is to slow down the interfacial reactions between the solder and the substrate metallization. The diffusion rate depends to a large extent on the elemental compositions of the solder and the solid metal. In this study, Cu wire having a diameter 250  $\mu\text{m}$  is immersed in the liquid composite solder at 250 $^{\circ}\text{C}$  up to 15 min. Composite solder were prepared by adding various amount of nano Mo into the Sn-3.8Ag-0.7Cu (SAC) solder paste. Generally the dissolution rate increases with increasing time but decreases with increasing the nano Mo content in the SAC solder. The IMC thickness increases with increasing the reaction time but nano Mo can hinder the growth of IMC layer. As a result, nano Mo is effective for the SAC solder to reduce the diffusion of copper substrate. [C903]

#### **"Intermetallics formation and evolution in pure indium joint for cryogenic application"**

Intermetallic compounds (IMCs) properties play a significant role in determining the reliability of solder joints in service. IMCs and their evolution become more important for devices with micro- or nano-scale joints used in cryogenic applications. In this study, the interfacial reactions of In/Cu and In/Ni/Cu due to low-temperature cycling are investigated. The results illustrate that the character of IMCs is linked to thickness of indium joints exposed to low-temperature cycling. The formation of Cu-In IMCs and Ni-In IMCs are diffusion-controlled, and low-temperature cycling results in brittle IMCs. [C904]

#### **"Crack and damage evaluation in low-k BEoL structures under CPI aspects"**

Miniaturization and increasing functional integration as the electronic industry drives force the development of feature sizes down to the nanometer range. Moreover, harsh environmental conditions and new porous or nano-particle filled materials introduced on both chip and package level-low-k and ultra low-k materials in back-end of line (BEoL) layers of advanced CMOS technologies, in particular-cause new challenges for reliability analysis and prediction. The authors show a combined numerical/experimental approach and results towards optimized fracture and fatigue resistance of those structures under chip package interaction (CPI) aspects by making use of bulk and interface fracture concepts, VCCT, X-FEM and cohesive zone models in multi-scale and multi-failure modeling approaches with several kinds of failure/fatigue phenomena. Probable crack paths and interactions between material damaging, ratcheting and interface fracture will be discussed. Complementary to the simulation side of reliability estimations, serious issues are connected with the collection of appropriate material properties in the miniaturized range addressed-Young's modulus, initial yield stress, hardening. Nano-indentation, AFM, FIB and EBSD provide these desired properties, in particular. In addition, residual stresses in the back-end layer stack caused by the different manufacturing processes have an essential impact on damage behavior, because they superpose functional and environmental loads. Their determination with a spatial resolution necessarily for typical BEoL structure sizes is shown with the help of a nano-scale stress relief technique (FIBDAC) that makes use of tiny trenches placed with a focused ion beam (FIB) equipment and digital image correlation algorithms. [C905]



### "Properties of conductive microstructures containing nano sized silver particles"

The properties of the structures made by ink-jet printing with the use of the ink containing nano silver sized particles are presented. After structures printing on substrate, to obtain good electrical conductivity, sintering process is necessary. It is shown, that thermal process influences strongly the resistance, and after the process the resistivity of printed structures can be only a little bit higher than the value of the bulk material. Also different electrical test proved similarity between printed and bulk silver. It was stated that the adding some polymer materials for mechanical parameters improving of printed materials up to 1.5% of total mass of the ink do not influence significantly electrical parameters of the printed layers. [C906]

### "Toward a Low Cost and Single Chip Holter: SoC-Holter"

In spite of the rapid development of medicine, cardiovascular diseases are still the number one killer in the world. In France every year more than 50,000 people die suddenly due cardiac arrhythmias. Identification of high risk sudden death patient is still a challenge. To detect the cardiac arrhythmias, currently Holter is generally used to record 1~3 leads ECG (electrocardiogram) signal during 24h to 72h. However the use of Holter is limited among the population due to its form factor (not user-friendly) and cost. In this paper, we propose an integrated single chip wearable Holter named SoC-Holter, which enables to record 1~4 leads ECG. This single chip SoC-Holter is relied on algorithm architecture adequation design methodology. To minimize energy consumption, CMOS technology (0.35 $\mu$ m) is used to prototype the first implementation and test. The SoC-Holter has the following functions: signal conditioner and preamplifier, amplifier and filters, analog to digital converter, and nano-controller. The low pass filter is composed of current division, degeneration and common-mode feedback circuits added to fulfill the required performance. The analog circuits are implemented, tested and validated. The digital bloc is simulated, implemented and tested. It seems that an integrated, low cost, and user-friendly single chip Holter is feasible. Consequently large number of high risk populations such as heavy smoker and obese may be monitored. [C907]

### "Optomechatronics: Challenges to smart integration of optical and mechatronic technologies with controllable and observable elements"

Optical elements enhance the functionality of mechatronics and in many cases introduce entirely new capabilities. Likewise, mechatronic elements bring the same synergistic effects to optical systems. This technology is termed "Optomechatronics" or "Optomechatronic Technology." This talk, with emphasis on importance of multi-disciplinary and multi-technology fusion, addresses the underlying concepts and features of the technology by analyzing a variety of practical optomechatronic systems such as optical storage systems, microscopes including AFM, micro-nano manipulation systems, MOEMS, adaptive imaging systems, laser printing systems, optical sensing and measurement systems, etc. The analysis decomposes a system into different functional units and identifies their functionalities required to generate desirable system performance. This analyzing process shows how the signals of optical and mechatronic elements are interacting together to produce the necessary functionalities and how such interaction can be achieved with the aids of controllable and observable elements. As an illustrative field, the later part of this talk focuses on an adaptive/controllable optical imaging which comprises control of imaging view direction, image distortion correction, selective imaging, image stabilization, image tracking, sensing and measurement, noise reduction, and so on. [C908]

### "An accurate approach for statistical estimation of leakage current considering multi-parameter process variations in nanometer CMOS technologies"

The dramatic increase in leakage current has become a major issue for future IC design. Moreover, as process variability in nano-scaled CMOS technologies induces a large spread of leakage power values, leakage variability cannot be neglected anymore. In this work an accurate analytic estimation and modeling methodology has been developed for CMOS circuit leakage under statistical process variations. The developed methodology is integrated with standard BSIM4 and PSP transistor model, and applicable to any CMOS technologies (90 nm, 65 nm, 45 nm), and SPICE simulators. Subthreshold, gate, BTBT, and GIDL leakage currents variations are considered. Comparisons with Monte-Carlo simulations on 45 nm STMicroelectronics CMOS technologies fully validate the accuracy and efficiency of the proposed method. [C909]

### "Comparison of double patterning technologies in NAND flash memory with sub-30nm node"

Fine patterning technologies-e-beam lithography, SPT (spacer patterning technology) and SaDPT (self aligned double patterning technology)-have been introduced to develop a single unit of nano-scale MOSFET. However, in order to achieve manufacturable high density NAND Flash memories, the merits and demerits of each technology should be considered in three points of view: device characteristics, process controllability and mass



production. In this paper, we suggest the appropriate technology for particular cell types, CTF (charge trap flash) cell, floating poly-Si gate cell, and for process steps such as active, gate and bit-line. [C910]

### "Measurement and control in micro-nano robotics and automation system"

There are many products available in micro and nano application markets and also research and development projects going around the world in the field of micro and nano robotics and automation systems. In this talk, some salient aspects from the macro to the micro and the nano world are first overviewed in the robotics and automation systems. Then it will be shown that the micro and nano manipulation technology plays important roles of measurement and control in the micro and nano robotics and automation systems for many fields. The basic technologies are fabrication, instrument and assembly in the micro and nano world, using MEMS and NEMS technologies with robotic manipulation technology. Some examples are the nano laboratory based on the nano robotic manipulation to deal with nano materials such as carbon nanotube and wire, nano sensor and actuator and others from the system viewpoint. The bio system and life science are also promising areas: There are many applications to the bio-medical areas, such as the medical robots and simulators, bio systems applications. Finally the concept of the "System Cell Engineering" is shown for an example of measurement and control in the micro and nano world. [C911]

### "Semiconductor nanowire sensors"

The physical fundamentals, constructions and parameters of particular devices in the field of chemical and biological sensors on the base of modulation of the conductivity of semiconductor nano-wires by surface charge are presented in this paper. The sensitivity and selectivity data for both single and matrix sensors are given as well. Devices for autonomic supplying for biosensors using the energy of moving living organism are describing. [C912]

### "Tubular micro- and nano- sensors and actuators for aerodynamics"

New data on the fabrication and study of semiconductor micro- and nanotubes, and also on the application of such micro- and nanotubes as basic elements in sensors and actuators are reported. Fabrication methods for tubular micro- and nanosensors and actuators are described, and examples of fabricated devices are presented. The potential offered by the fabricated pilot devices in aerodynamic applications is demonstrated. [C913]

### "Novel control and peripheral technologies proposed for future hard disk drives"

New technologies of discrete track recording (DTR), bit patterned media (BPM) and thermally assisted magnetic recording (TAMR) have been proposed for next generation hard disk drives. To realize these technologies, there are other big challenges required for head positioning in order to follow eccentricity of recording tracks to the center of spindle motor, for read write clock synthesis synchronous to the eccentricity and platter warpage, and for high frequency signal transfer in GHz band. This paper proposes novel solutions of an actuator control method with a voltage driver and an over sampled local feedback, an eccentricity analysis algorithm for discrete tracks without referring to embedded servo patterns, a phase locked loop clock synthesizer with a variable loop counter, and a super wide band flexible cable with new materials. The performances are evaluated and demonstrated on a head-media test system and this paper reports the result and proposes the applications for future hard disk drive products. [C914]

### "Bio-inspired devices, circuits and systems"

Despite their enormous computational powers, digital computers today are inferior to humans in such tasks, like seeing events happening in front, perceiving and recognizing them by intuition and association, and making a decision to take an immediate action. It is very unlikely that computers will become intelligent as humans in this sense by just increasing the number of transistors on CPU chips. How can we approach this problem by learning from biological systems of their computing principles? This is the main theme of this article. We are aiming to develop a new-paradigm computing system most suited to such human-like intelligent information processing by best utilizing the state-of-the-art silicon technology. For this end, we have developed a series of VLSI chips dedicated to specific brain-mimicking processing using digital, analog as well as mixed-signal circuit technologies. There is an opportunity of even using exotic current-voltage characteristics of nano functional devices directly in such computation. In this paper, we will also discuss how we can circumvent the serious issue of the nanoscale integration, i.e., the variability problem of device characteristics that is inherent in nanoscale devices. [C915]

### "Development of 3-D shapes estimation by using single X-ray image"



X-ray images are heavily affected by noise which makes normal image processing not workable. This paper suggested a new method to identify the primary 3-D shape of an embedded object and its pose by using only single X-ray image. The image feature consists of corner points and edge/intersection lines of adjacent surfaces. The intensity of an X-ray image is attenuated exponentially with increasing the penetration thickness. The main finding is to model a precise exponential relationship to fit the variation of X-ray image intensity. It applied a least-square-method to the X-ray projection image and effectively extracted edges and intersection lines from the noise of X-ray image. [C916]

#### "Bio-inspired devices, circuits and systems"

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#### "Dynamically Adapted Low-Energy Fault Tolerant Processors"

The constant advances on scaling have introduced several issues to the design of processing structures in new technologies. The closer one gets to nano-scale devices, the more necessary are methods to develop circuits that are able to tolerate high defect densities. At the same time, beyond area costs, there is a pressure to maintain energy and power dissipation at acceptable levels, which practically forbids classical redundancy. This paper presents a dynamic solution to provide reliability and reduce energy of a microprocessor using a dynamically adaptive reconfigurable fabric. The approach combines the binary translation mechanism with the sleep transistor technique to ensure graceful degradation for software applications, while at the same time can reduce energy by shutting off the power supply of the unused and the defective resources of a reconfigurable fabric. [C918]

#### "Prediction of the behavior of a microcantilever based optomechatronic force sensor by finite element method"

The main goal of this study is the presentation and development of a novel optomechatronic force sensor based on optical coupling between two waveguides. Static and partially dynamic behavior of proposed system will be studied here. [C919]

#### "Fault Tolerance in FPGA Architecture Using Hardware Controller-A Design Approach"

With advancement in process technology, the feature size is decreasing which leads to higher defect densities. More sophisticated techniques at increased costs are required to avoid defects. If nano-technology fabrication are applied the yield may go down to zero as avoiding defect during fabrication will not be a feasible option Hence, feature architecture have to be defect tolerant. In regular structure like FPGA, redundancy is commonly used for fault tolerance. In this work we present a solution in which configuration bit-stream of FPGA is modified by a hardware controller that is present on the chip itself. The technique uses redundant device for replacing faulty device and increases the yield. The design is implemented using FPGA Altera Quartus II EC121Q240C6. [C920]

#### "Femtosecond laser fabrication of optical sensors integrated in a lab-on-a-chip"

Lab-on-a-chips (LOCs) are becoming one of the most powerful tools of analytical chemistry, with a broad application in life sciences, biotechnology and drug development. They incorporate in a single substrate the functions of a biological laboratory (i.e. microfluidic channels, reservoirs, valves, pumps and sensors). Their main advantages include the possibility of working with small sample quantities (from nano- to picoliters), high sensitivity, speed of analysis and the possibility of measurement automation and standardization. Direct on-chip integration of photonic devices for detection of biomolecules flowing in the microchannels is one of the main objectives of current research in this field, which becomes particularly challenging in case of analytes that cannot be chemically labeled. In fact in this case an interferometric detection is often needed and optical devices, such as interferometers, have to be integrated. Ultrafast laser writing of waveguides in glasses proves to be a very



flexible, simple and well suited method also for this kind of applications. As a post-processing technique it doesn't affect the fabrication of the fluidic part and its unique three-dimensional capabilities allow realization of devices with complex design. In this work we report on the use of femtosecond laser pulses to fabricate a Mach-Zehnder interferometer, integrated with a microfluidic channel; this provides label-free sensing, by means of refractive index measurements, of samples flowing in the microchannel. [C921]

### "High-resolution high-speed spectral domain optical coherence tomography"

We have designed the spectral domain optical coherence tomography system using a broadband superluminescent diode laser source and home-built spectrometer, which acquires 2D or 3D images with high speed and high resolution. We have also introduced the N-point complex FFT algorithm, which is faster than 2N point real FFT, into the signal processing part, thus shortening signal processing time after image data acquisition. For the sake of convenient measurements, the spectral domain optical coherence tomography was manufactured in the form of a microscope. The volumetric image of a mouse anterior eye could be reconstructed from a few hundred 2D images. [C922]

### "Title page"

The following topics are dealt with: human-computer interaction; assistive technology; systems safety; systems security; human-computer symbiosis; information retrieval; soft computing; image processing; pattern recognition; discrete event systems; computational intelligence; human centered transportation systems; type-2 fuzzy logic systems; type-2 fuzzy logic control; manufacturing systems; manufacturing automation; smart sensor networks; environmental decision support systems; environmental visualization systems; intelligent learning; user interface design; biometric systems; bioinformatics; evolutionary computation; grey systems; human-machine cooperation; human-machine systems; virtual reality systems; augmented reality systems; systems engineering; systems sustainability; medical systems; health care systems; conflict resolution; intelligent Internet systems; intelligent RFID systems; Web intelligence; Web interaction; agent-based modeling; intelligent signal processing; human-machine interface; human-machine communications; human factors; design information systems; marketing information systems; brain-based information communications; swarm intelligence; management engineering; machine learning; cognitive radio; mobile robot intelligent control; distributed intelligent systems; vehicle, driver, environment and control system; multimedia systems; knowledge acquisition; robotic systems; human performance modeling; interactive media; digital media; granular computing; heuristic algorithms; fuzzy systems; self-organization systems; complex distributed systems; Petri nets; Kansei; image sharing; image retrieval; collaborative wireless sensor networks; enterprise information systems; visual information processing; fault monitoring; fault diagnosis; large-scale systems; intelligent transportation systems; neural networks; machine vision; fuzzy forecasting; information assurance; homeland security; intelligent multimedia computation; decision making; infrastructure systems management; collaborative virtual workspaces; distributed software systems; media computing; optimization; collaborative commerce; uncertain systems control; cybernetics; intelligent power systems; artificial immune systems; systems biology; collaborative manufacturing; supply chains; mechatronics; nonlinear control systems; intelligent multimedia-mobile communications; nano systems; micro systems; reliability engineering; role-based systems; role-based quality; and cooperative systems. [C923]

### "Effect of device density on the uniformity of silicon nano-photon waveguide devices"

We report wavelength selective device nonuniformity of 1 nm over a 200 mm SOI wafer using CMOS fabrication technology. We also report correlation between device density and nonuniformity. [C924]

### "VLSI circuit design concept for parallel iterative algorithms in nanoscale"

Modern VLSI manufacturing technology has kept shrinking down to the nanoscale level with a very fast trend. Integration with the advanced nano-technology now makes it possible to realize advanced parallel iterative algorithms directly which was almost impossible 10 years ago. In this paper, we want to discuss the influences of evolving VLSI technologies for iterative algorithms and present design strategies from an algorithmic and architectural point of view. We can simplify the parallel implementation of the iterative algorithm (i.e., processor elements of the multiprocessor array) in any way as long as the convergence is guaranteed. However, the modification of the algorithm (processors) usually increases the number of required iterations which also means that the switch activity of interconnects is increasing. We implemented a 3times3 Jacobi EVD array with the mu-CORDIC PE in both 0.18  $\mu\text{m}$  and 45 nm technologies in order to further study the trade-off between the performance/complexity of processors and the load/throughput of interconnects. Our experimental results show that using the mu-CORDIC PE is beneficial concerning the design criteria since it yields smaller chip area, faster overall computation timing and less energy consumption per operation than the full CORDIC PE. [C925]



### "Micro and nano robotics"

The paper presents two techniques for controlling of micro/nano robots. The first one uses so called visual servoing techniques, where the robot tip position is measured with a camera. The position of the robot tip is extracted from the live video picture, so on-line position feedback control can be established. The experimental results of 2 DOF micro robot neural network controller with resolution of 500 nm is presented. The second presented experiment will show research results of 5 DOF nano robot cell with a gripper with resolution of 62 nm. The so called adaptive bang-bang position controller will be presented. The position of each linear axis is measured by a magnetic incremental encoder. The presentation focuses to the experimental results achieved by so called interface for prevention of collision in the nano world. We use a haptic device to get feeling of a touch in the nano world. [C926]

### "High speed and low power ADC design with dynamic analog circuits"

This paper discusses high speed and low power ADC design with dynamic analog circuits. An OpAmp based ADC design is no longer useful in nano-meter CMOS era and a comparator based ADC design becomes dominant for ADC design along with technology scaling. Offset mismatch and input referred noise in a comparator affects ENOB seriously. Furthermore conversion speed, energy consumption and occupied area have a serious tradeoff in ENOB. A digital offset mismatch compensation technique accommodates this trade off, however accuracy is not sufficient and more effective technique should be developed. An equation to estimate the input referred noise in dynamic comparator has been deduced and it suggests that the noise can be reduced by increase of load capacitance and reduction of the effective gate voltage. However higher resolution than 10 bit looks not easy. Technology development is required to realize higher resolution ADC. [C927]

### "Power-efficient and fault-tolerant circuits and systems"

As devices become smaller, circuits and systems are more vulnerable to soft errors caused by radiation and other environmental upsets. Fault tolerance measured by mean time to failure (MTTF) is desired, especially if no extra area, power and delay and little change of the existing design flow are introduced. Using FPGA as a testbed, this paper first presents fault tolerance techniques applying (1) logic don't care and path re-convergence (ROSE) and (2) in-place logic re-writing (IPR). Both increase MTTF by 2X with little or no overhead. Particularly, IPR does not change circuit placement and routing, and can be readily used with the existing industrial design flow. It also leads to a self evolution method to enhance fault tolerance for FPGA based circuits and systems. The ideas presented in the paper can be extended to handle regular logic fabrics, which are natural to nano-technologies and are also preferred by design for manufacturability (DFM) in scaled CMOS technologies. [C928]

### "Can the regulatory framework cope with nano- and other converging technologies?"

Presented is a list of slides. Topics include: medical technology innovation; e-medicine; telemedicine; bioinformatics; micro and nanoelectronics; regenerative medicine; nanotechnology; and biophotonics. [C929]

### "Energy modeling in carbon nano tube based wireless sensor networks"

We have analyzed the effect of innovations in Nanotechnology on Wireless Sensor Networks (WSN) and have modeled Carbon Nanotube (CNT) based system. We have shown the integration of CNT in WSN and formulated a Nano routing system. A proposition is put forward by us on the changes needed in the existing sensor node structure to improve its efficiency and to facilitate and enhance the assimilation of CNT based devices in a WSN. We have shown the functioning of CNT based Nano devices in WSN technology. Finally we have commented on the challenges that exist in this technology and described the important factors that need to be kept under consideration for the calculation of the energy of CNT based WSN. [C930]

### "DNA computation model based on self-assembled nanoparticle probes for 0-1 integer programming problem"

0-1 integer programming problem is an important problem in opsearch with widespread application. In this paper, a new DNA computation model based on self-assembled nanoparticle probes is presented to solve this problem. This is the first time to integrate with nanoparticle and oligonucleotides in DNA computation model. Major benefits of this method include vast parallelism, extraordinary information density and easy controllable operation. The result reveals the potential of DNA computation based on nano technology in solving complex integer programming problem. [C931]

### "SOI-a platform for transition from micro to nano"



Silicon on insulator (SOI)-based devices are the best candidates for the ultimate integration of ICs on silicon. The performance and physical mechanisms are addressed in single- and multi-gate thin film Si and alternative channel material MOSFETs. The impact of tensile or compressive uniaxial and biaxial strains in the channel down to ultra thin film and ultra short gate length, of high k materials and metal gates as well as metallic Schottky source-drain architectures are discussed. The interest of SOI-based emerging- and beyond-CMOS nanodevices for long term applications, based on nanowires and small slope switch structures is presented.

[C932]

#### "GHz FBAR and SAW resonators manufactured ON GaN/Si"

This paper presents the manufacturing and the microwave characterization of FBAR and SAW type resonators on GaN thin films grown on a high resistivity (111) oriented silicon substrate. The resonators have been manufactured using advanced micromachining technologies (for the FBAR structures) and nanolithographic techniques (for the IDT of the SAW structure). FBAR structures working at frequencies higher than 5 GHz have been obtained. For the SAW type structures a resonance at 4.8 GHz has been obtained for 250 nm fingers series connection of the SAWs, and 7.1 GHz for 100-150 nm fingers face to face SAW structures. [C933]

#### "Efficient capacitance solver for 3D interconnect based on template-instantiated basis functions"

In this paper we show how the highly restrictive design rules of the recent sub-micro to nano-scale integrated circuit technologies allow to use a limited number of pre-computed surface charge distributions as a set of fundamental template basis functions in an efficient integral equation based 3D capacitance solver. Several examples verify that our solver can achieve final accuracies of less than 2% using 5 times to 30 times fewer unknowns than standard piecewise constant basis functions for the same accuracy, resulting in up to 25 times speedups. [C934]

#### "Progress in thermal characterisation methods and thermal interface technology within the "Nanopack" project"

As the demand for new thermal technologies and materials has been increasing over the years to provide thermal solutions to the next generation of power electronics, microprocessors and high-power optical systems also thermal characterisation methods have to keep up with the pace of this development with respect to resolution and accuracy. Within the EU-funded project "Nanopack" we have developed both bulk and interface technologies to reduce thermal resistance using Ag-based materials and low-T and low-p processes to render them eligible for the electronics industry. New processes to generate nano-enhanced surface structures as well as thermo-compression bonding are examined within this paper. Along with these processes especially designed test stands are described which are able to extract the effects achieved by the technological advances.

[C935]

#### "Electro-thermal modeling of nano-scale devices"

In this paper we present simulation results obtained with our electro-thermal device simulator when modeling different technology generations of FD-SOI devices. In particular, we stress out the importance of the temperature boundary conditions for digital and analog circuits and the use of the full model which takes into account both temperature and thickness dependence (which is particularly important for thin silicon films) of the thermal conductivity. [C936]

#### "Presentation and status of the NANOPACK project"

NANOPACK-Nano Packaging Technology for Interconnect and Heat Dissipation-is a European large-scale integrating project aiming at the development of new technologies and materials for low thermal resistance interfaces and electrical interconnects, by exploring the capabilities offered by nanotechnologies such as carbon nanotubes, nanoparticles and nano-structured surfaces, and by using different enhancing contact formation mechanisms, compatible with high volume manufacturing technologies. Several key research areas relative to thermal management, interconnect and packaging are addressed in the project by European industrial and academic partners: thermal interface materials, assembly, reliability and characterisation, supported by modeling and simulations. After an overview of NANOPACK, a status of the project progress is presented in these different fields. [C937]

#### "Relating reliability to circuit topology"

Reliability analysis of nano-scale circuits can be done using different techniques, one of them being Bayesian networks. Using this scheme, the relationship of circuit's topology to reliability has been studied for several



thousand randomly generated (combinational) 3 to 9 variable circuits; the circuits contained up to 40 gates in up to 10 tiers/levels. As anticipated, strong, positive correlations were found between gate counts and circuit's probability of failure (PF), and between the level counts and circuit PF. However, the input counts and the circuit PFs were weakly correlated. These findings can be useful in creating reliability models for arbitrary circuits.

[C938]

#### "DC characteristics of Junction Vertical Slit Field-Effect Transistor (JVeSFET)"

This paper presents a simulation based feasibility study of deep-submicron JFETs obeying an extreme layout regularity, that is a foundation of a new vertical slit geometry ICs (VeSTICs) vision proposed in. DC characteristics obtained for symmetrical dual gate JVeSFETs have been investigated in a wide range of bias voltages. As a conclusion an assessment of applicability of these devices in nano-size era SoCs is proposed.

[C939]

#### "Comparison of fault-tolerance techniques for massively defective fine- and coarse-grained nanochips"

The fundamental question addressed in this paper is how to maintain the operation dependability of future chips built from forthcoming nano- (or subnano-) technologies characterized by the reduction of component dimensions, the increase of atomic fluctuations and the massive occurrence of physical defects. We focus on fault tolerance at the architectural level, and especially on fault-tolerance approaches, which are based on chip self-diagnosis and self-reconfiguration. We study test and reconfiguration methodologies in massively defective nanoscale devices, either at fine granularity field programmable devices or at coarse granularity multi-core arrays. In particular, we address the important question of up to which point could future chips have self-organizing fault-tolerance mechanisms to autonomously ensure their own dependable operation. In the case of FPGAs, we present known fault tolerant approaches and discuss their limitations in future nanoscale devices. In the case of multicore arrays, we show that such properties as self-diagnosis, self-isolation of faulty elements and self-reorganization of communication routes are possible. [C940]

#### "Why should we care about input vectors?"

As the size of future (nano-)devices is aggressively scaled deep into the nanometer range, the design and manufacturing of future (nano-)circuits will become extremely complex and inevitably introduce more defects and transient faults. Therefore, accurately calculating the reliability of future designs will become a very important factor for (nano-)circuit designers. This paper investigates the relationship between input vectors and the reliability of the output signal. The paper introduces the critical gate concept and highlights their effects on the circuit's reliability. Simulation results show that the circuit's reliability depends heavily on the status and location of the critical gates. [C941]

#### "Particles delocalization in nanostructures with complex energy profile under the action of external perturbation"

When creating the nanoelectronic devices, a number of problems arises: incorporation of discrete nanoelectronic devices and their simplest assemblies into the structure of the standard microelectronic circuits having the stable technological realization; creation of purely nanoelectronic circuits; creation of reliable electrical connections both between nano dimensional elements of the circuits and between nano and microelectronic components; temperature stability of nanoelectronic elements; bringing of newly created nanoelectronic element base parameters to the existing standards on one or another kind of devices, or creation of new standards; suppression of undesirable effects in the operation of the new element base, their origin is connected with the quantum nature of the physical processes taking place in the active zones of nanoelectronic devices etc. This work is devoted to research into quasi-continual states emerging in multilayer quantum-well structures, when the internal potential barriers are lower than the external ones, particles energetic states far above the main states in separate quantum confined regions emerge between them and are also subjected to quantum confinement.

[C942]

#### "Generation of nano-structured surfaces by liquidly process induced by interfering femtosecond laser processing"

Top down technology of ultra-short pulse laser processing was applied to induce liquidly process and generate new nanostructures such as nano-waterdrop, nanocrown, and nanowhisker-on-bump. [C943]

#### "On wires driven by a few electrons"



When analyzing reliability, wires have mostly been ignored, and gates and devices have taken the lion's share. With scaling, this computing-level approach will become less-and-less accurate as communication (wires) will also start failing. Trying to do justice to communication, this paper details a reliability analysis of wires following on the few papers which have made wires' reliability their concern. We will use a classical particlelike probabilistic approach to enhance on the accuracy of the wires' length-dependent probabilities of failure due to the discreteness of charge. Integrating intrinsic noises, such a communication approach leads to lower bound-like wire reliability estimates-as ignoring extrinsic noises, variations, and defects. These results should have implications for design strategies of emerging nano-architectures, as well as multi/many-cores and networks-on-chip. [C944]

#### **"An Improved Molecular Dynamics Algorithm for Large Scale Simulation in Nano-Engineering"**

Focusing on the special need of nano-engineering, an improved neighbor list algorithm for the ultra-large scale molecular dynamics (MD) simulation is proposed. The new algorithm is attempting to fully combine the advantages of both Verlet table and cell-linked list algorithms to accelerate the speed of neighbor list construction and update. In order to meet the requirement of nano-engineering that often requires the frequent update of the cell-linked lists and neighbor lists, the program employs the pointer link data structure so that both reliability and accuracy of the simulation can be ensured. The performance of molecular dynamics simulation is evaluated using the proposed algorithm and compared with those using conventional Verlet table and cell-linked list algorithms. Results show that the new algorithm outperforms the conventional cell-linked list algorithm by 2~3 times for systems of 104~ 106atoms per single CPU. [C945]

#### **"Cantilever sensors equipped with nano sensing effects for ultra-sensitive detection of bio/chemical molecules"**

The paper presents micromechanical cantilever sensors with self-sensing element integrated for trace-level bio/medical detection. To significantly improve sensing performance, nano-size related effects are found and utilized that mainly come from surfaces/interfaces. Such effects can be categorized into three kinds, which sequentially are the surface effects due to the cantilever dimension shrunk into nano-scale, the effects at the interface between the solid surface of the cantilever (or its modified surface) and the self-assembled sensing molecule-layer, as well as, the size effects from the nano-metric signal self-sensing elements integrated in the cantilevers. With the nano-effects equipped, trace-level bio/chemical detecting experiments of the cantilever sensors and their promising applications are also related. [C946]

#### **"Minimized blurring in stencil lithography using a compliant membrane"**

This work reports on advanced stencil lithography using compliant membranes. Compliant membranes are mechanically decoupled from a rigid silicon frame by means of four non planar cantilevers. Compliant membranes are protruding parts which adapt to the surface independently in order to reduce the gap between a membrane and its substrate. FEM simulations show that compliant membranes can vertically deflect 40  $\mu\text{m}$  which is a typical maximal gap. Microapertures were defined using UV lithography and nanoapertures, down to 200 nm in diameter, using FIB. A 100 nm thick aluminum layer was evaporated through compliant and non compliant membranes on a silicon wafer. Subsequent SEM characterizations have shown a smaller halo diameter around the structures patterned by compliant membranes. [C947]

#### **"Atomic layer deposition enabled interconnect technology for vertical nanowire array devices"**

In this study, we have demonstrated atomic layer deposition (ALD) enabled interconnection technology for vertical, as-grown c-axis oriented GaN nanowire (NW) arrays encapsulated by benzocyclobutene (BCB). The nano-scaled ALD multilayer is essential to provide conformal dielectric/conductor coverage and precise thickness control for NW interconnects. Cross-sectional images taken in a focused ion beam (FIB) tool and resistance measurement performed on the NW devices confirms the conformality of ALD-W films. This interconnect technology can be applied to different vertical nanowire array devices, such as nanowire light emitting diodes (LEDs), metal semiconductor field effect transistor (MESFET), resonator or solid state super-capacitors. [C948]

#### **"pH-responsive drug-delivery devices for implantable applications"**

A drug-delivery microdevice integrating pH-responsive nano-hydrogel composite membranes functioning as intelligent nano valves is described. The polymeric microdevices are monolithic without requiring peripheral control hardware or additional components for controlling drug-release rates. pH-responsive nanoparticles were synthesized and embedded into a composite membrane. The resulting pH-responsive composite membrane was integrated with PDMS micro reservoirs to form the proof-of-concept microdevices. In vitro release



characterization of the microdevices was conducted in which the release rate of Vitamin B12 (VB12) as a model drug increased dramatically when the local pH value was decreased from 7.4 to 4. By adjusting nanoparticle percentages, drug reservoir shape and size, and drug loading concentrations, complex drug release profiles in response to local pH changes can be achieved, functioning as a platform technology for intelligent drug delivery. [C949]

#### "Implantable polycrystalline diamond neural probe for in vivo and in vitro physiological recording"

A second generation (Gen-2) diamond neural probe equipped with both electrical and electrochemical recording abilities is reported for the first time. Fabrication problems related to the high temperature and power requirements associated with diamond growth and the integration of diamond into neural probe technology have been addressed. In this design, polycrystalline diamond (poly-C) is used as the material for the probe's shank and working electrode. Ag/AgCl and gold are used for reference and counter electrodes, respectively. The probe's efficacy for in vivo electrical recording and in vitro electrochemical detection of Norepinephrine ( $\sim 10$   $\mu\text{M}$ ) is demonstrated. [C950]

#### "CMOS-MEMS knife-edge optical spot profiling system"

The knife edge technique is commonly used to measure tightly focused optical spot profiles with sub-wavelength or nano-meter resolutions. In this paper, we demonstrate a micro scanning knife edge system by using the CMOS-MEMS technology. The scanning actuator, the photodetector, and the signal conditioning circuit, are all integrated and fabricated in the same device by the TSMC 0.35  $\mu\text{m}$  2P4M technology. The mechanical and electrical properties of various components in the system were characterized. Measurement of focused optical spot profiles at different wavelength and numerical apertures were successfully demonstrated. [C951]

#### "Stress-assistant selective etching mechanism for lithography-independent nanofabrication"

We report a novel stress-assistant selective etching (SASE) mechanism for nanofabrication, which is discovered that tensile stress can increase dry-etching rate. By introducing patterned stress, this mechanism can realize selective etching, and be used to achieve nanostructures independent of lithography. Based on the mechanism, we employ focused ion beam (FIB) to introduce stress while milling, and successfully fabricate a sub-100 nm nano-pore and a shuttle-shaped structure with 10 nm nano-cantilevers on a 96.9 nm-thick crystal-silicon film without restrictions of lithography as well as the precision of FIB-processing. Using the SASE mechanism with stress distribution patterns, we are possible to acquire desired nanostructures. [C952]

#### "Terahertz nanoresonators: Control and measurements"

We discuss a new and exciting area whereby terahertz science and technology meet nano-world and thin-film technology. We first show that a  $\lambda/30,000$  nanogap on metal film can efficiently transmit terahertz electromagnetic waves whose wavelengths are in the millimeter range. It was found that the transmittance continues to increase as the frequency decreases with a dependence of  $1/f$ . The field enhancement reaches the value of  $\sim 1000$  at 0.1 THz. The accumulation of charges at metal edges via light-induced currents creates a large horizontal electric field, which in effect attracts the incoming light, while the magnetic field enhancement is only orders of unity. Turning into two-dimensional nanoresonator, we design nano-antenna arrays that allow perfect transmission. Nanoresonators on VO<sub>2</sub> thin films help amplify the available dynamic range for extinction and transmission when it undergoes insulator-metal phase transition. [C953]

#### "Terahertz nanogap antenna for detection of nano-rods"

We have measured transmission properties of a composite structure consisting of nano-rods on a long ( $a_y = 300$  micron) nano gap (70 nm) on Au film in broad frequency range of 0.1 THz to 1.0 THz using THz time-domain spectroscopy. The normalized transmittance with no nano-bridge or nano-rod structure in the middle shows a half-wavelength resonance: the resonance frequency is  $\sim c/(2na_y)$  where  $n$  is the index of refraction of the substrate. The nano-size bridge at the center of the nano gap gives changes the resonance characteristics profoundly, because in essence, the length  $a_y$  now halves. Mostly the same resonance-changing behavior is expected with a nano-rod structure fabricated by Pt-deposition method using a focused ion beam (FIB). This small rod also acts as a bridge dividing the length of the rectangle. The structure dependent resonance allows to detect nano-size particles and to tailor resonance characteristics with feature sizes of  $\lambda/10,000$ . [C954]

#### "Improve the Portability of J2ME Applications: An Architecture-Driven Approach"

The porting of J2ME applications is usually difficult because of diverse device features, limited device resources, and specific issues like device bugs. Therefore, achieving high efficiency in J2ME application porting can be



challenging, tedious and error-prone. In this paper, we propose an architecture-driven approach to help address these issues through improving the portability of J2ME applications. It abstracts and models the features that affect porting tasks using component model named NanoCM (nano component model). The model is described in an architecture description language named NanoADL. Several open source J2ME applications are used as the case studies, and are evaluated using metrics indicating coupling, comprehensibility and complexity. Experiment results show that our approach effectively improves the portability of J2ME applications. [C955]

### "Electrostatic Charging and Precipitation of Diesel Soot"

Exhaust treatment systems consisting of new catalyst technologies and particulate filters is indispensable to meet increasingly stringent global regulations limiting particulate matter (PM) and nitrogen oxide (NOx) emissions from heavy duty and light duty diesel vehicles. Diesel particulate filter (DPF) has been established as a key technology in reducing diesel particulate emission. However, pressure drop, durability and insufficient collection efficiency for nano-particles call for technological improvements. Electrostatic Precipitation (ESP) is another leading technology used in exhaust treatment but it is currently limited to applications for stationary sources. In this paper we have proven that concurrent use of DPF and ESP show synergetic effects with very high collection efficiency and slower rise up of the pressure drop. The number density of particles observed downstream of the combined system was 98% less compared with that of DPF only. In addition, it was confirmed that increase in the pressure drop of the DPF was slower. In this study, filter that exposed exhaust gas was observed by using SEM (Scanning Electron Microscope). In addition, the electrical impact with the electrification particle on the surface of the filter was considered with a sucking type Faraday cage. The influence that the diesel particulate exerted on DPF by such an experiment was able to be clarified. Moreover, as the accumulation of PM causes breakdown, it is necessary to remove the PM for stable operation. In this study surface discharge was also examined to remove accumulated PM. It has been demonstrated that the surface discharge could also oxidize not only the oxidation of PM but also NO. [C956]

### "Micromachined tube-type of Si droplet generator"

We developed the novel type of droplet generator for the bio-chemical reactions, and designed it by considering Reynolds and Weber numbers. The Si droplet generator was fabricated on a silicon-on-insulator wafer by using deep-reactive ion etching and was fixed in a piece of heat-shrinkable tubing by heating the tubing. We experimentally confirmed that the fabricated droplet generator formed droplets in 1 mm diameter with jetting. [C957]

### "Microfabricated neural thermocouple arrays probe for brain research"

A microfabricated neural thermocouple arrays probe (NTAP) is proposed for measuring and comparing the temperature of local brain area in real time sensing. Four junctions of T type thin film thermocouple arrays were fabricated on a sharp silicon probe tip. Each junction size was 20  $\mu\text{m}$  by 20  $\mu\text{m}$ . The average seebeck coefficient was 15.12  $\mu\text{V}/^\circ\text{C}$  and the dynamic response time was 0.78 sec. The temperature of both inside and outside the mouse's thalamus was measured. The result showed that the temperature inside the mouse's thalamus was about 4degC higher than that of the outside. [C958]

### "MEMS for space"

Future space exploration will emphasize on cost effectiveness and highly focused mission objectives. Missions costs are directly proportional to its total weight, thus, the trend will be to replace bulky and heavy components of space carriers, communication and navigation platforms and of scientific payloads. MEMS devices are ideally suited to replace several of these components in the future, first by substituting larger and heavier components (e.g. a gyroscope), then by replacing entire subsystems (e.g., inertial measurement unit), and finally by enabling the microfabrication of highly integrated picosats. This progressive approach will also enable new mission scenarios and more detailed investigations of the space environment and of planetary surfaces. Very small satellites (1 to 100 kg) stand to benefit the most from MEMS technologies because reaching the desired performance levels is only possible using a highly integrated approach. The small satellites are typically used for science or technology demonstration missions, with much higher risk tolerance than multi-ton telecommunication satellites. In addition, the ability to mass produce MEMS components opens a new approach to space exploration in the future by sending constellations of nano and picosatellites into space. Examples of such miniaturization and successful use of MEMS for space and planetary missions are described in this paper. [C959]

### "From silicon direct wafer bonding to surface nano-patterning: a way to innovative substrate elaboration"

Self-assembled configurations of nanostructures are expected to play an increasingly important role in devices



design, as an alternative to conventional microelectronics technology. Conventional techniques are generally limited by the lack of simultaneous control on positioning, density and size uniformity of the nanostructures. To overcome these problems a new substrate based on controlled direct twist wafer bonding and preferential chemical etching has been developed. [C960]

#### "RF devices written with carbon nanotube ink on paper"

Carbon nanotubes are expected to produce a breakthrough in the entire microwave domain due to their amazing properties such as high mobility, huge Young modulus, and very large density currents. In reality, up to now there are only few carbon nanotube RF circuits with performances that overcome the existing microwave devices based on semiconductors or fabricated in other technologies. The reason is that there are many technological difficulties related to nano-technologies, which are still immature in comparison with standard semiconductor technologies developed in the last half of a century. Therefore, nonconventional technologies, such as bottom-up approaches, are expected to play a considerable role in the development of RF carbon nanotube devices. The role of this paper is to show that simple RF devices such as tunable resistances or reactances, can be written with a carbon nanotube ink on normal paper to be used in passive tags or simple radio configurations. [C961]

#### "Fractal geometry of reliefs and surface potentials in epitaxial gallium arsenide and barrier metallization"

It is shown that relief forms of surface and character of distribution of potential irregularities of epitaxial gallium arsenide and barrier Au-metallization have fractal geometry, which in a local approximation must be defined as geometry and homogeneity of metal -semiconductor contact interfaces with Shottky barrier. This must be considered while designing the submicron and nano metal-semiconductor contacts. [C962]

#### "Localized states of nanodimensional semiconductor structures"

The approach to the description of nanodimensional semiconductor structures based on definition of own energy that picked up from the Schroumldinger's equation which to enable to formalize the disordered atomic matrix is presented. Parameters of the aperiodic lattice, providing the quantitative and qualitative specification of a defect of crystal structures, are presented. The comparison of a modeling own energy spectrum with the energy distribution for centers of experimental samples gives possibility to describe a nuclear matrix internal structure for working layers of nano-devices. [C963]

#### "Application of Jacobi-Davidson algorithm to 2-D eigen-mode problems in printable electronics"

Thin nano-particle conductors of the order of micrometer in thickness are typical for printable electronics technology. A two-dimensional (2-D) eigenmode solver based on Jacobi-Davidson algorithm is applied to printable transmission lines to evaluate the conductor loss. Efficient preconditioning for the interior solver is utilized to treat poorly-conditioned complex system matrix arising from the fine discretization of conductors required to accurately model the conductor loss. The solver can be used to determine the required layer thickness and conductivity for a desired line loss as well as to the analysis of wide-band material characterization results. The approach is used to determine actual material parameters from wide-band extraction results for inkjet-printed dielectric and nano-silver conductor. [C964]

#### "An internally amplified signal SOI nano-bridge biosensor for electrical detection of DNA hybridization"

Despite all technical improvements in semiconductor industry, technology development in biomedicine still requires a lot of improvement to satisfy the current need. Impedance biosensors are a class of electrical biosensors that show promise for point-of-care and disease discovery due to real time, low cost, ease of miniaturization and label-free operation. This paper outlines how the modulation of impedance in a novel silicon nano-bridge (nanowire) biosensor can be used in characterizing biochemical species such as an antibodies/antigens or for detection of a particular DNA sequence hybridization. [C965]

#### "Nano-tera.CH: Nano-technologies for tera-scale problems"

The Nano-Tera.CH initiative is a broad engineering program in Switzerland for health and security of humans and the environment, currently funded by the Swiss government. The program rationale is rooted in advances in engineering nano-scale materials and their exploitation in a variety of systems, requiring extreme integration and coordinated control of diverse micro/nano-scale components. Embodiments of such systems can be found in lightweight, mobile and personalized products embedded in the environment and on/in the body. These products will enable us, for example, to detect in real time different health risks and conditions through integrated bio



probing, to reveal security risks through smart buildings and environments, to save energy through ambient sensing, and to detect and monitor environmental hazards such as floods and avalanches from space and/or inaccessible positions on earth. The outstanding novelty and power of these systems stem from their connectedness and the integration of heterogeneous components. [C966]

#### **"An Intelligent Peak Search Program for Digital Electron Diffraction Images of 3D Nano-Crystals"**

Electron diffractograms are lattice images of crystalline samples taken in transmission electron microscopy for molecular structure determination studies. Electron diffraction is a technique widely used in material science and recently it is gaining significance also in life science for studying 2D and 3D organic crystals. However, often the images suffer from strong background noise, masking the data points. Moreover, they suffer also from the strong center beam exposure or a big beam-stop which covers a lot of useful information. This paper presents a user-friendly peak search program in which an autocorrelation algorithm is utilized creatively to intensify the signal and to center the image in the particular regular lattice. An adaptive background removal algorithm is designed to remove the central beam and to reduce the background noise. The latter algorithm can be used for a wide range of applications, such as 2D spectral analysis in physics, NMR Analysis, stars recognition of aerospace photographs. [C967]

#### **"Wet etched complex three dimensional MEMS structures"**

The present research reports the fabrication techniques for the formation of complex three dimensional structures. The process is developed using very economic wet anisotropic etching in pure and surfactant Triton X-100 [C<sub>14</sub>H<sub>22</sub>O(C<sub>2</sub>H<sub>4</sub>O)<sub>n</sub>, n= 9-10] added 25 wt% tetramethyl ammonium hydroxide (TMAH) solutions. The structures are fabricated in single and nitride-based silicon on insulator (SOI) Si{100} wafers. In single wafer, both fixed and suspended structures are manufactured, while in SOI wafers only freestanding structures are realized. The present research is aimed to enhance the range of 3D structures fabricated using wet etching. [C968]

#### **"Partial discharge endurance test on several kinds of nano-filled enameled wires under high-frequency AC voltage simulating inverter surge voltage"**

Partial discharge (PD) endurance test was performed on twisted pair specimens of enameled wires consisting of polyamide-imide resin with nanometer-size fillers. Specimens were prepared with containing nanometer-scale silica or titania fillers, as well as specimens without fillers. In the PD endurance test, so-called V-t characteristics of the twisted pair specimen were measured by applying a constant ac voltage 1-2 kVrms at 10 kHz that simulated repetitive impulse voltage appearing in an inverter-fed motor. Temporal change of the thickness depletion of a tested specimen was also measured with a microscope. Moreover, the relation among PD charge estimated from measured PD current pulse, the thickness depletion and the life of the specimens were investigated. Experimental result revealed that the life of specimens with titania nano-fillers was longer than that of specimens with silica nano-fillers. It was also found that the thickness depletion caused by PD charge for the former was longer than that for the latter. [C969]

#### **"Low refractive index contrast double slot structure based cantilever type sensor"**

Since the advent of slot optical waveguides by Lipson, normally SOI based slot optical waveguides have been under consideration. It has been found that glass based slot optical waveguide structures, where refractive index contrast ratio is comparatively less can also play important role in forming complex nano size optical devices. We have made use of power confined inside low index slot region for a double slot structure, where central high index slab is acting as a cantilever. Novel optomechanical sensor has been proposed based on variation in power confined inside low index slot region due to the movement of central high index slab under the action of external force (temperature, pressure, humidity, etc.) [C970]

#### **"Laser sintering of the printed silver ink"**

Because flexible electronics have a weak characteristic in high temperature, the conductive ink including nano-metal particles is printed on flexible substrate by printing methods such as screen printing, inkjet printing, and R2R. Due to high electrical resistance of printed metal ink, the process to improve the property of electrical conductivity is needed. To improve the conductivity, the furnace curing is used after printing the ink on the substrate. But this process spends much time for curing. Therefore, flexible substrate or glass substrate can be damaged due to long exposed time. The curing by using a laser is utilized to minimize the damage of flexible substrate. In this work, the specific resistance of silver ink by using furnace curing at the temperature of 250°C after 30 minutes is 3 ГfB— 10-8ГfB/m. The specific resistance of silver ink by the laser curing at the power of 5 W from 5 sec to 10 sec is 2. 38 ГfB— 10-8ГfB/m. Consequently, the curing time by using the laser is



significantly smaller than that of the furnace curing. [C971]

### "Remarkable potential of pattern based computing on an organic molecular layer using the concept of cellular automata"

We have assembled molecular multi-level switches (0, 1, 2, 3) on an atomically flat metallic substrate (Figure 1 a). The molecules self-assemble in the form of an organic bi-layer. Each molecule functions as a cellular automata (CA) cell when assembled in an ordered pattern, otherwise they are conductance switch. The molecular bi-layer satisfies three fundamental criteria of cellular automaton circuitry. First, the single molecule cell, or a small area of molecules  $\Gamma, \text{Bi}$  updates  $\Gamma, \text{Bi}$  itself independently of the distant neighborhood (parallelism). Secondly, the new CA state depends on the distribution of states of its immediate surroundings (locality). Third, the laws that govern the state of a molecule do not change over the entire surface (homogeneity). In spite of following the fundamental properties of CA, there are crucial issues need to be addressed before we use the CA template for a real-time computation. In this letter, several such issues have been addressed leading to the conclusion that a simple realization of CA template can lead to the realization of remarkable computing power that was otherwise impossible to realize using existing hardware. [C972]

### "Space charge formation in low-density polyethylene up to breakdown influenced by addition of MgO nano-filler under DC ramp voltage"

To understand the space charge formation of nano-sized magnesium oxide (MgO)/low-density polyethylene (LDPE) nanocomposite materials, the space charge up to the breakdown has been investigated under DC increasing ramp field. A negative charge was dominated in 0 phr sample. A positive charge was dominated in nano-composite sample. The field increment (= the maximum field-the average field) of 0 phr increased with increasing average field and then was saturated with a few rises and falls before the breakdown. In case of 1 phr sample, after showing the peak the field increment turned to decrease with further increase of the average field. In case of 2 phr and more, the clear decrease of the field increment was not observed due to a few positive charges. The space charge distributions of 1 phr shows different distribution between 1 st and 2 nd filed applications while that of 0 phr did not. From these results, it was considered that the homo space charge effect at the anode brought by charge trapping effect of MgO nano-filler controlled the space charge formation in nano-composite. [C973]

### "Nanotechnology for lead-free PWB final finishes with the Organic Metal"

For the first time, a thin layer of only a few nano-meters has been deposited onto copper pads of printed circuit boards which provides effective protection against oxidation and preserves its solderability. The Nano layer has a thickness of nominally only 50 nm, and contains the Organic Metal (conductive polymer) and a small amount of silver. With >90% (by volume), the Organic Metal is the major component of the deposited layer, Ag is present equivalent to a thickness of 4 nm. This Organic Metal-Ag complex final finish outperforms any established surface finishes. [C974]

### "Carbon nano tubes grown on glass substrate with different interface layer"

Microwave plasma enhanced chemical vapor deposition (MPECVD) was applied in growing carbon nano tubes (CNTs) on sodium free glass with different interface layer materials. Surface morphology and field emission characteristics of as grown CNTs were measured. Three different materials: titanium (Ti), gold (Au) and indium tin oxide (ITO) thin films were prepared on glass first as the interface role between CNTs and glass. Nickel (Ni) films were sputtered on three different interface films and also direct on glass. After hydrogen plasma pretreatment on nickel films, CNTs were tried to grow on four kinds of glass combination: Ni/glass, Ni/ITO/glass, Ni/Au/glass and Ni/Ti/glass, three substrate temperatures: unheated, 300°C and 500°C, with the mixture of methane and hydrogen microwave plasma. It was found CNTs can be grown with high CNTs density, high adhesion and 2.5 V/ $\Gamma, \text{Bi}$  m turn on electric field corresponding to Ni/Ti/glass and 500°C process condition. The same MPECVD system with same pretreatment and process gas can be used to grow CNTs on silicon substrate without extra substrate heating. It is proposed the electrical conductivity of substrate has strong influence on CNTs growth. The interface material like Ti can modify the electrical conductivity of the substrate surface. [C975]

### "Multi-scale Modeling for Nano Scale Phenomenon Using CUDA Based Framework"

The essence of high performance computing (HPC) in the field of computation nanotechnology and problems encountered by HPC arrangement in applying HPC to Nano-enabled calculations have been presented in the paper. A proposal to optimize computations in an HPC setup has been formulated to make nanotechnology computations more effective and realistic on a CUDA based framework. Results and findings in the expected



setup and the computation complexities that will be needed in its implementation have been suggested with an algorithm to take advantage of inbuilt powerful parallelization capabilities of GPU making large scale simulation possible. Implementation of CUDA in certain complex techniques in nanotechnology is presented with a significant improvement in performance as compared to the last work which was implemented using distributive computing toolbox in MATLAB. We have discussed about the problems that exist and how we can optimize the computations in a HPC setup and how we can make use of computational power of GPU to make nanotechnology computations more effective and realistic. A description of the progress in this area of research, future works and an extended approach in the same field is shown. [C976]

### **"Keynote 1: The Role of Functional Memories in Parallel Information Processing with Localized and Distributed Systems"**

The analysis of parallel information-processing systems, independent of their realization in localized or distributed form, reveals that the necessary data exchange between data-storage and data-processing parts of the system represents a major limiting factor for the system performance. Therefore, in addition to the number-crunching power of the processing parts, innovations which substantially improve the bandwidth of the data exchange are essential for advances in the overall system capabilities. To be practically useful, such innovations must in particular carefully balance the bandwidth of the exchanged data amount against the required power dissipation for this purpose. We review the main methods for achieving the data exchange improvements, namely (a) an increased memory-access bandwidth by multi-porting of the memory and (b) a unification of memory and processing parts of the information-processing system. We further present the advances in VLSI architectures for realizing the higher data-exchange bandwidth by applying advanced nano-technologies and discuss practical implementation examples for parallel processors as well as for pattern-matching and pattern-recognition systems. [C977]

### **"Digital school"**

The way of building the digital education in Azerbaijan is offered in this presentation. The development of e-education creates digital school. Digital schools are assumed as if they are the combination of interactive pedagogical technological in e-education. The presented constructive education's 3 structural model is considered education technology of digital school. The modernization of contents in education and the creating elements of constructive education is presented. [C978]

### **"A Novel Hardened Design of a CMOS Memory Cell at 32nm"**

This paper proposes a new design for hardening a CMOS memory cell at the nano feature size of 32 nm. By separating the circuitry for the write and read operations, the static stability of the proposed cell configuration increases more than 4.4 times at typical process corner, respectively compared to previous designs. Simulation shows that by appropriately sizing the pull-down transistors, the proposed cell results in a 40% higher critical charge and 13% less delay than the conventional design. Simulation results are provided using the predictive technology file for 32 nm feature size in CMOS to show that the proposed hardened memory cell is best suited when designing memories for both high performance and soft error tolerance. [C979]

### **"Microwave based technique for ultra-fast and ultra-high temperature thermal processing of compound semiconductors and nano-scale Si semiconductors"**

The 'hotter and faster' trend in rapid thermal processing (RTP) of semiconductors requires RTP equipment to be capable of reaching very high temperature along with very fast ramping and cooling rates. To fulfill the critical needs of the future RTP technology, LT technologies (LTT) has been developing a solid state, cavity-less and variable frequency based microwave technology capable of generating high-power, short-duration, spatially uniform, and material-specific microwave pulses. Ultra-high temperatures above 2000 $^{\circ}$ C can be reached within a fraction of second. Moreover, the use of microwaves has an advantage of selectively heating the targeted features within the wafer volume while essentially having no significant thermal effects on other parts of wafer materials with different electrical properties. A PC based control system is also developed to regulate temperature uniformity and stability. In this paper, the results on post implant annealing of Al+implanted 4H-SiC, and Mg+implanted GaN using LTT's microwave RTP apparatus are discussed. These results demonstrate that microwave RTP technology offers significant improvements in performance and quality of SiC and GaN compound semiconductors including: (1) unprecedented ultra-low sheet resistance (2) very high carrier mobility and (3) perfect lattice damage recovery and defects elimination. Discussion will also be given to address the potentials and advantages of LTT's microwave technology in applications of millisecond annealing of Si based ultra-shallow junction (USJ) devices. [C980]



### **"Characterizing and mitigating the impact of process variations on phase change based memory systems"**

Dynamic Random Access Memory (DRAM) has been used in main memory design for decades. However, DRAM consumes an increasing power budget and faces difficulties in scaling down for small feature size CMOS processing technologies. Compared to conventional DRAM, emerging phase change random access memory (PRAM) demonstrates superior power efficiency and processing scalability as VLSI technologies and integration density continue to advance. Nevertheless, using nano-scale fabrication technologies will unavoidably introduce design parameter variability in the manufacturing stage. In the past, the impact of process variation (PV) on conventional transistor-based storage cells and combinational logic has been studied extensively. However, the implication of PV on non-volatile memory design using emerging phase change techniques has not been well understood. In this paper, we take the first step toward characterizing the effect of process variation on PRAM and explore PV-aware design techniques. We show that process variation increases the PRAM programming power by 96% and degrades PRAM endurance by 50X. Our proposed circuit and two microarchitecture techniques with system-level support reduce PRAM power by 44%, 59% and 57% and improve PRAM endurance by 27X, 277X and 268X, relative to PV-affected PRAM design. Moreover, we show that the synergy of the proposed cross-layer approaches, which achieve an average 63% power savings and 13050X endurance improvement over the conventional case, provide an attractive design solution to mitigate the deleterious impact of PV for non-volatile memory in the upcoming nano-scale processing technology era. [C981]

### **"Micro- / nano- structuralized interfaces of conductive and transparent thin-film microelectrodes for biomedical application"**

Planar thin-film microelectrodes have been developed based on conductive and transparent thin films of ZnO:Al which are applicable in biomedicine as well as in the thin film solar cells. Nano-structuralization of their interfaces (surfaces) was carried out by the ion-sputter etching and by the photo-assisted electrodeless chemical etching. Interdigital array of microelectrodes was verified as a very useful tool for biomedical application: the monitoring of blood state or psychogalvanic reflex. [C982]

### **"A novel fabrication method to integrate super hydrophobic nanostructures into microfluidic systems"**

Novel nano microfluidic systems hold the potential to be used for innovative biomedical applications such as the encapsulation of single cells. Droplet-based microfluidic systems are able to resolve precisely biological processes running in small droplets according to their reaction time and place. High throughput analysis of biological substances such as cells can be achieved with droplet-based systems due to the serial flow of the droplets. One challenge so far is the fabrication of low cost microfluidic systems which are able to generate droplets at stable high rates and with a constant droplet volume. One approach to this problem is the fabrication of microfluidic systems with super hydrophobic channel walls so that a periodic droplet break up with a constant volume is ensured. This assumption was indicated by the results of simulations performed with channel systems having super hydrophobic and hydrophilic surface properties. Hence, we present a novel fabrication method to create microfluidic systems with tubular channel walls having super hydrophobic surface properties realised by a combination of hot embossing and thermoforming. Experiments were conducted with surface modified and unmodified microfluidic systems. The results obtained during the experiments verified the simulation assumptions: a periodic droplet break up with a constant droplet volume could be observed with microfluidic channel systems having super hydrophobic surface properties and an unstable droplet break up leading to different droplet volumes could be observed with the unmodified systems. These novel nano microsystems furthermore allow the design and cheap fabrication of biocompatible systems with several different thermoplastic polymers which makes this fabrication method highly flexible. [C983]

### **"Proposal of heavily doped silicon between insulators MOSFETs and confirmation of their advantages by device simulation"**

The performance of short channel silicon between insulators (SBI) MOSFETs and the proposal of heavily doped silicon between insulators (HDSBI) MOSFETs, in which silicon region between local buried oxide (BOX) regions is heavily doped are presented. The electrical and thermal advantages in short-channel regions over conventional SBI MOSFET are verified by device simulation. Also, electrical properties of these MOSFETs considering thermal effects, impact ionisation, and quantum effect will be presented. [C984]

### **"A versatile compact model for ballistic 1D transistor: Applications to GNR-FET and CNT-FET"**

This paper presents a versatile compact model dedicated to ballistic 1D transistors that are fabricated in very



advanced technologies, in order to predict the ultimate performances of novel nano-device-based circuits. The results presented here after are related to MOS like CNTFET and GNRfet thanks to a unified expression of the non parabolic energy dispersion relation NPEDR which enhances other tentative works limited to the parabolic case and to Boltzmann approximation. To warrant the accuracy as well as the flexibility of this compact model for ballistic ID transistor, we have developed a thermionic charge model based on NPEDR. [C985]

### "Correlation between high-density trap states and local stress near SOI/BOX interface in SIMOX wafers"

Separation by implanted oxygen (SIMOX) wafers and bonded wafers are commercially available silicon-on-insulator (SOI) wafers. In particular, SIMOX process technologies have become important in system-on-a-chip (SoC) fabricated on SOI/Bulk hybrid substrates composed of SOI region for the logic circuits and bulk region for the dynamic random access memories (DRAMs) in recent years. However, we found that low-dose SIMOX wafers have energetically localized acceptor-like and donor-like trap states with the density of  $10^{11}\text{cm}^{-2}$  at the SOI/buried oxide (BOX) interface by back-gate characteristics. In addition, we estimated that the high-density trap states are distributed within about 30 nm from the SOI/BOX interface in SOI layer by front-gate characteristics in MOSFETs with SOI layers of different thicknesses. Furthermore, we speculated that the distribution of the trap states in the SOI layer is attributed to nano-scale roughness at the SOI/BOX interface, which is peculiar to the SIMOX process. In this paper, we discuss the origins of the high-density trap states in SOI layer of SIMOX wafers considering the roughness at the SOI/BOX interface. [C986]

### "Micro and Nano Electro Mechanical Systems (MEMS/NEMS) for Mobile Computing Systems"

Micro and Nano Electro Mechanical Systems (MEMS/NEMS) are disruptive interdisciplinary technologies that can manifest in multiple components in portable systems. Such technologies will play an important role in enabling smaller, more efficient, and faster mobile computing systems. Integrated Radio Frequency MEMS components are front-runners as alternative technologies to replace bulky off chip RF time keeping and frequency control components. MEMS switches co-fabricated with MEMS resonators and filters would reduce the complexity of current mobile platform antennas and extend the reconfigurability of these antennas to operate on a wider range of frequency bands. This paper presents the current mobile platform usage and suggested areas for MEMS/NEMS technology intercepts with a focus on the wireless subsystem. [C987]

### "Preparation and characterization of nano-inorganic materials coated multi-walled carbon nanotubes/epoxy composites for thermal interface materials"

Recent developments of nanofabrication have enabled the miniaturization of electronic devices, allowing more electronic devices to be combined into a single device with a high performance. However, the complex devices have led to the escalation of power dissipation as well as the increasing heat flux at the interface between devices. Electronic devices were damaged by much heat accumulation, since the reliability of devices is dependent on the junction temperature. For example a small operating temperature difference (in the order of  $10\sim 15^\circ\text{C}$ ) can result in a two times reduction in the lifetime of a device. Carbon nanotubes with large aspect ratio and unique thermal properties can be as thermal dissipating filler for some nanocomposites. However, carbon nanotubes with high electrical conductivity will induce short leakage at the same time. For overcoming this problem, the objective of this research is to propose the surface modification technology by inorganic materials on the carbon nanotubes for thermal interfacial materials (TIM) applications. This research is to develop the surface modification technology by depositing alumina nanoparticles on the surface of the multi-walled carbon nanotubes (MWCNTs). TIMs were prepared from epoxy resin and various content of alumina @ MWCNTs (1~5 phrs) and then their volume resistivity with different loading alumina @ MWCNTs content can maintain round  $10^{15}\Omega\cdot\text{cm}$ . The thermal conductivity of a TIM with 5 phrs alumina @ MWCNTs was  $1.01\text{ W/mK}$  (increased 677% compared to neat epoxy resin with  $0.13\text{ W/mK}$ ). [C988]

### "Thermal management in high performance computers by use of heat Pipes and vapor chambers, and the challenges of global warming and environment"

The trend of the computer processors performance and power consumption has been increased significantly each year. Heat dissipation has been increased but in contrast the size of die on the processor has been reduced or remained the same size due to nano-size circuit technology and thus the heat flux is critically high. The extreme high performance processors heat flux can be over  $100\text{ W/cm}^2$ , which is likely 10 times higher than the surface of the household standard clothes iron. The intention of this paper is to provide insight into various thermal management solution using heat pipes and vapor chambers as heat transfer devices. This paper includes designs, data, and discussions of various fan sink air cooling designs showing how the design changes to push the limit of the air cooling capability. The utilization of the two-phase fluid phenomena to spread the heat



was a key factor to be the leader of extending the air cooling limit capability for high performance computers. In addition to the thermal management for computers, in this paper also include consideration use of heat pipes to prevent global crisis of global warming and environmental impact by reducing green house gas emission. For example, use energy based cooling system such as heat pipes and cold storage system for partial cooling in the existing cooling system of data center can reduce the power electric assumption of the cooling system. Another example such as use of heat pipe to prevent icebergs and glaciers melting in Arctic ocean. Finally, the authors make recommendation what and which way we are going to develop for next generation of high power cooling chips, and our endeavor to use heat pipes in potential application to reduce global warming. [C989]

#### "Call for papers second international workshop on compact thin-film transistor (TFT) modeling for circuit simulation"

In recent years, the increasing use of active matrix flat-panel displays and bio-medical imagers in commercial electronic products has drawn a significant attention to thin-film transistors (TFT) and technologies. TFTs on amorphous- and poly-silicon as well as newly emerging organic, transparent metal oxide and nano-composite semiconductor technologies are becoming increasingly common. For example, flat panel displays are finding widespread use in many products such as cellular phones, personal digital assistants (PDAs), camcorders, laptop personal computers (PCs), to name a few. The active matrix display is composed of a grid or matrix of picture elements called as "pixels". Thousands or millions of these pixels together create an image on the display, in which the TFTs act as switches to individually turn each pixel. More increasingly TFTs are starting to be used as analog circuit elements for rudimentary signal conditioning. Therefore, physically-based compact modeling of TFTs for circuit simulation is crucial to accurately and reliably predict TFT behavior in the active matrix. A concentrated R&D effort is critical for developing physically-based compact TFT models for emerging thin-film technologies, and significant R&D efforts along these lines are underway world-wide. [C990]

#### "The ITRS metrology roadmap"

This paper was focused on the 2009 international technology metrology roadmap for semiconductors based on front end processes, interconnect, lithography, and process integration roadmaps. Recent measurement innovations for high-k-metal gate material stack and measurement necessary for new transistor design were discussed. Graphene was emphasized for characterisation and device applications and properties were analyzed using methods such as TEM, LEEM, nano-Raman and several scanned probe methods, and other multiscale simulations. [C991]

#### "Thermal conductivity of nano-filled epoxy systems"

Epoxy resin systems are used in high voltage transformers, cable terminations, bushings, power apparatus, or insulation for X-ray tubes. They could be used more widely, but low thermal conductivity limits their applications. Polymers used as insulating materials generally lack the ability to dissipate excess heat efficiently. The aim of this study is to investigate the influence of different types and filler loadings of electrically insulating-but thermally conductive -nanosized particles on the thermal conductivity of epoxy resin. The concentration of the filler is varied from 0.5 wt.% to 5 wt.%. A combination of ultrasonic processing and high shear force stirring is used to obtain an even dispersion of the corresponding filler in the base material. A silane coupling agent is used for surface functionalization of the nanoparticles. The application of the coupling agent improves the compatibility of the particles with the base polymer. Morphological characteristics of the samples are determined by using transmission electron microscope observation. The composites of epoxy resin containing nanoscale particles showed improved thermal conductivity values compared to epoxy resin without particles. The experimentally measured thermal conductivity results are compared with theoretical and empirical models for two component systems. [C992]

#### "Dielectric properties and resistance to corona and ozone of epoxy compositions filled with micro- and nano-fillers"

This paper describes activities aiming to evaluate and compare the resistance to a prolonged corona and ozone exposure for a range of epoxy based compositions filled with micro- and nano-fillers of silica at different proportions. It has been earlier shown for this system that substitution of 5 wt% of micro-filler by nano-filler slightly improved mechanical properties, yielding an increase in Young's modulus, tensile strength and elongation at break. At the same time, the toughness of the systems decreased with the addition of nano-fillers indicating a poor particle-matrix interaction, which was in accordance with the prior art claiming that this interaction is weaker in case of SiO<sub>2</sub> nano-particles, as for example compared to Al<sub>2</sub>O<sub>3</sub> nano-particles. For the exposure to corona and ozone a methodology employing a multiple-needle electrode system was used, as recommended by CIGRE working group WG D1.14. Measurements of surface resistivity, bulk resistivity as well as dielectric response (DR)



at broad frequency range (10-4-103Hz) were performed on new samples of the investigated compositions and after each of two sequences of the corona-ozone treatment, lasting 100 hours each. It was found that the long-term corona-ozone exposure had obvious effect on surface resistivity for all the compositions investigated and the contents of the micro- and nano-fillers played a significant role in the observed changes. On the other hand, bulk resistivity, dielectric permittivity as well as dissipation factor, all being the properties of material bulk, did not exhibit high sensitivity to the exposure. [C993]

#### **"Synthesis and dielectric properties of epoxy based nanocomposites"**

Insulation based on epoxy resin is widely used in high voltage applications. This paper shows the formulation of epoxy based nanocomposites and the influence of the filler material on the DC breakdown strength. Filler materials discussed are SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub> and AlN with average particle size between 22 and 100 nm. AlN has been chosen because it has shown to considerably increase the thermal conductivity of epoxy resin. SiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub> are widely used as filler for electrical applications since they improve mechanical, thermal and electrical properties, beside neat epoxy samples, which have been used as reference. Base material for all samples is conventional bisphenol-A type epoxy resin with anhydride hardener. Particle size and dispersion within the epoxy matrix have been validated via transmission electron microscopy. Breakdown measurements have been performed by means of DC ramp tests. Results of nano-Al<sub>2</sub>O<sub>3</sub> samples have also been compared with surface functionalized microscale filler. [C994]

#### **"Space charge accumulation and breakdown in LDPE and LDPE/MgO nano-composite under high dc stress at various temperatures"**

The relationship between space charge accumulation and breakdown at various temperatures is investigated by observing the space charge formation in low density polyethylene (LDPE) and LDPE/MgO nanocomposite material under dc high stress. We have reported, earlier, that, enhancement of electric field in LDPE by packet-like charge under dc stress might be a cause of its electrical breakdown. Furthermore, it has been found that such enhancement does not take place in LDPE/MgO nanocomposite under the same conditions. Therefore, it is believed that the addition of MgO to LDPE results in suppression of charge injection. To understand the effect of temperature, we tried to observe the charge accumulation under high dc stress at various higher temperatures. This is reported in this paper. It is seen that the packet like charge, in LDPE, plays an important role on the electric breakdown at higher temperature. On the other hand, the suppression effect of charge injection by MgO nano filler is still working well even at higher temperatures. [C995]

#### **"Resistive switching characteristics of solution-processible TiO<sub>x</sub> using nano-scale via-hole structures"**

In this study, we successfully demonstrated ReRAM device with active area below 1  $\mu\text{m}^2$ , using solution-processed TiO<sub>x</sub>/Bi in via-hole structures. [C996]

#### **"A nano-scale molecular rotor device for high density memory application"**

A novel electrically driven molecular rotor device has been designed and fabricated. NDR behaviors were observed owing to the rotation motion on the Cu axel. This is the first time that a rotation induced NDR effect on a solid support was observed. The rotation of the molecules was also confirmed using the optical absorption spectroscopy. From temperature dependence measurements, the activation energy of the rotation was estimated to be 0.3 eV based on the Arrhenius plot. [C997]

#### **"Electric characteristics of MgO/LDPE nanocomposite up to breakdown under DC ramp voltage"**

To understand DC breakdown phenomena of low density polyethylene (LDPE) mixed with nano-sized magnesium oxide (MgO), the electric properties, namely, DC breakdown strength, conduction current, space charge formation and local heat generation up to the breakdown under increasing field with a particular rate of increase was investigated. DC breakdown strength of nanocomposite was found to be high compared to that of LDPE. The increasing rate of the conduction current in nanocomposite with respect to the average field (under high field) was suppressed by the addition of MgO nano-filler. The space charge formation and the local heat generation were also suppressed under high field. From these results, it is suggested that the suppression effect of conduction current affected by the space charge led to higher DC breakdown strength of nanocomposite material. [C998]

#### **"Errors in DNA Self-Assembly by Synthesized Tile Sets"**

This paper presents a study of errors that occur in DNA self-assembly using synthesized tile sets for template



manufacturing. It is shown that due to the reduced size, aggregates assembled by a synthesized tile set are not error-free as those assembled by maximum-sized (referred to as a trivial tile set) as well as non-synthesized tile sets. Compared with non-synthesized tile sets, aggregates assembled using synthesized tile sets also have a higher error rate at high tile concentration, but they exhibit a lower rate at low tile concentration. In this paper, it is also shown that errors in synthesized tile sets tend to appear in clusters. This is very different from non-synthesized tile sets of non-maximum size in which growth errors are mostly random in nature. These findings are discussed and evaluated for nano manufacturing (such as for template self-assembly of a QCA circuit).

[C999]

#### "Device scaling for 15 nm node and beyond"

In summary, as we move it 15 nm and beyond, it is critical that the device structure fit in ever smaller footprint. It seems that Si devices can fulfill this key requirement: moving from thick body devices to thin body and ultimately to Si nano-wires, in order to enable small gate length devices. This is the good news. Better news could be if we are able to find a device that can do better than Silicon MOSFET. [C1000]

#### "Affect of Pressure on Photoreduction of CO<sub>2</sub> to Acetaldehyde in Aqueous Suspensions of TiO<sub>2</sub>"

A new equipment which bears high pressure was designed for heterogeneous photocatalysis. Acetaldehyde was the major product on suspend nano anatase titanium dioxide in liquid phase. The yield of acetaldehyde was increased with an increase in the pressure of CO<sub>2</sub> at first, then decreased sharply with further increase in the pressure after an optimum pressure. What's more, the optimum pressures were varied against different temperatures. The yield of acetaldehyde could increased by as much as 3.51 times. [C1001]

#### "Yeast-Directed Hydrothermal Synthesis of ZnMoO<sub>4</sub> Hollow Microspheres and Its Photocatalytic Degradation of Auramine O"

Using yeast cells as natural bio-templates; ZnMoO<sub>4</sub> hollow microspheres have been successfully synthesized. The as-obtained products are characterized by SEM, XRD and FT-IR. The results showed the ZnMoO<sub>4</sub> hollow microspheres, with the diameter ranging from 1.5  $\mu\text{m}$  to 2.5  $\mu\text{m}$ , retained the morphology of yeast templates fairly well. The as-synthesized hollow spheres are constructed from ZnMoO<sub>4</sub> nano-particles of monoclinic phase. Furthermore, a probable mechanism for formation is proposed. Photocatalytic activity of the ZnMoO<sub>4</sub> hollow microspheres are studied by the photocatalytic degradation of Auramine O in solution. [C1002]

#### "Knowledge politics of nano-interdisciplinarity"

In late-modern societies, knowledge constitutes a major component of any human activity. Knowledge politics-a field of political activities concerned with the production, application, monitoring and control of new knowledge and knowledge-based technoscientific innovations-has gained importance over the last 30 years. A central term in recent knowledge politics is  $\Gamma$ Biinterdisciplinarity $\Gamma$ Bi. The vagueness of this term, however, appears to be a disadvantage for any public discourse on goals and objectives of any specific knowledge politics. In addition to what has been achieved in the field of reflection on interdisciplinarity (ID), the aim of this paper is to provide a philosophical foundation for a classification and criticism of the innumerable usages of interdisciplinarity in present knowledge politics. With regard to established positions in the philosophy of science, different types of ID can be distinguished: the object type ( $\Gamma$ Biontology $\Gamma$ Bi), the theory type (epistemology), the method type (methodology), and the problem / purpose type. Based on this classification I will show which specific type of ID is involved in the NSF's scenario on converging technologies-one of the most prominent kinds of knowledge politics. This type of interdisciplinarity will be contrasted with the research program of the European Commission on converging technologies. [C1003]

#### "A systematic technology forecasting approach for New and Emerging Science and Technology: Case study of nano-enhanced biosensors"

This paper addresses the topic of anticipating likely development paths for a particular  $\Gamma$ BiNew and Emerging Science & Technology $\Gamma$ Bi (NES&T). Characteristics of NES&T-technological uncertainty and contextual dynamics-pose challenges for technology management and forecasting practices. Researchers, technologists, R&D managers, staff in funding agencies and policy makers  $\Gamma$ Bineed to know $\Gamma$ Bi future prospects. This requires better ways to capture NES&T development patterns, within their socio-economic context, as well as likely innovation opportunities. A new technology forecasting framework for NES&Ts is presented, supported by a case study of nano-enhanced biosensors. [C1004]

#### "Assembly of functional nanodevice using platinum/ tungsten nanowire"



This paper presets the assembly of a functional device with double metal nanowire. A PZT cantilever was used for electrodes of the device and etched by FIB. Two carbon nanotubes (CNT) were assembled to the separated electrodes of PZT cantilever. A tungsten probe is etched by focused ion beam (FIB) into 300 nm in diameter and 25.4  $\mu\text{m}$  in length. Then the probe is coated by parylene and cut the tip to open the tungsten. A tungsten nanowire with 907 nm in length and a platinum nanowire with 209 nm in length grew from the tip of the CNTs via field emission by introducing hexacabonyl tungsten and trimethyl cyclopentadienyl platinum individually inside a field emission electron microscope. [C1005]

#### "Research on conductive performance of inkjet printing samples by conductive inkjet ink"

By using the liquid-phase chemical reduction method, under the protection of PVP at the use of hydrazine hydrate reduction of silver nitrate, obtain a nano-silver suspension of high concentration. After adjusting parameters such as surface tension, conductive ink-jet ink was prepared for printing on. With digital microscopes, scanning electron microscopy (SEM) and four-probe tester, different samples of printing times were characterized. Results show that samples which printed for more than two times have conductive capability. Printing samples will be treated by washing treatment, low temperature heating treatment and laser sintering treatment. It was found that its conductive performance can be improved. One of the post-treatments by the laser sintering could obtain a best proof which's surface resistance reduced to 4  $\Omega/\square$  after sintering which was 270  $\Omega/\square$  previously. [C1006]

#### "WsVsSenNet: An Era of Enhanced Vision Based Sensing Capability"

Flexible and multi-adaptive platforms are always being appreciated by the people. In the field of Information Technology the wireless vision sensor network is one of the fastest growing segments. Due to their flexibility of networks and easily deployment in the field of businesses, educational establishments and households; this becomes an integral form of life. In recent years, we have seen the unparalleled research progress in wireless sensor network, which viable the emergence of enhanced nano sensors. Their multi functionality, small cost and less size always actuate their deployment over large number of applications. The deployment of the Wireless Vision Sensor Network [WsVsSenNet] in active monitoring field emergence the requirement of various sensor network protocols, algorithms and on board processing platforms. This paper deals with the continuous, interactive and integrative research efforts in the field of wireless sensor network for enhanced vision based applications. During the execution period, we have deployed the wireless sensor network in active monitoring field and found that the various on boards processing platform doesn't hold their grasp over the whole network. This paper provides a frame work for the emergence and enhancement of the wireless sensor network. The major design challenges, their solutions and various platform requirements of wireless sensor network are also been included in this paper. To make the discussion healthier various design implementation difficulties are also included in this paper. The low power CMOS imaging with enhanced vision capability brings the emergence of the new era in this direction. [C1007]

#### "Testing Embedded Memories in the Nano-Era: Will the Existing Approaches Survive?"

With the technology scaling and increase in integration density, severe static (e.g., random dopant, subwavelength lithography, etc) and dynamic (e.g., voltage, temperature, etc) variations will rise. It is widely recognized that variability in device characteristics and its impact on the overall reliability of the system represent major challenges to scaling and integration for present and future nanotechnology generations. Moreover, the failure mechanism in the nano-era will be more dominated by transient faults (e.g., external perturbations, radiation, power fluctuations) and intermittent faults (e.g., timing faults, degradation of the component parameters) rather than permanent faults. This shift in failure mechanisms will impact the reliability in a sever way. It is becoming very hard to guarantee the reliability with today's extensive, hence costly, traditional approaches (e.g., testing at extreme stresses, Burn-in, etc). Moreover, such approaches may reduce the lifetime of devices fabricated using nano technology nodes. As new failure mechanisms emerge, the existing test approaches may need to be changed and/or adapted to guarantee the outgoing product quality. The question is now how to deal with this shift in failure mechanisms in order to keep an acceptable product quality for embedded memories. Can the existing test approaches do the job? Do we need to rely more on stresses rather than the algorithms themselves? However, too much stress/ Burn-in may degrade the lifetime of the chip. Do we need to move more towards DFT rather than functional testing? Is programmable DFT the ideal solution? Can on-the-fly detect/repair and reconfigure be the answer? Or do we need completely new approaches? [C1008]

#### "Delay Fault Diagnosis in Sequential Circuits"

The importance of delay faults proportionally increases when entering in the nano-technology era, and logic diagnosis must localize delay faults as precisely as possible to speed-up yield ramp-up. This paper presents a



logic diagnosis approach targeting delay faults. The proposed approach is based on the single-location-at-a-time (SLAT) paradigm used to determine a set of suspects. It addresses the case of sequential circuits tested at-speed. The main advantages of this approach are that it can manage a comprehensive set of delay faults, and that it is independent on the size of the delay (induced by the fault). Experimental results show the effectiveness of the proposed approach in terms of absolute number of suspects. [C1009]

#### **"Realization assessment of stabilizer with presonication on size-distribution of itraconazole nanoparticulate in wet-nanomilling"**

The paper investigates fabrication of itraconazole nanoparticulate in wet-nanomilling by appropriate alteration of the suspension properties and the milling parameters. By wet-nanomilling, stable nano-scale particulate can be prepared which have better physical properties. In this study, effects of adding stabilizer on nanoparticulate size and polydispersity index were performed during production of itraconazole nanoparticulate. In addition, the effect of pre-sonication followed by wet grinding was assessed on the particulate size of itraconazole in dispersion containing stabilizer. The size of drug particulate was reduced to less than 200 nm with a polydispersity index (PDI) below 1.0 thus influencing the milling process under these conditions. [C1010]

#### **"Hydrogen-Rich Gas Production from Steam Gasification of Palm Oil Wastes Using the Supported Nano-NiO/γ-Al<sub>2</sub>O<sub>3</sub> Catalyst"**

The catalytic steam gasification of palm oil wastes for hydrogen-rich gas production was experimentally investigated in a combined fixed bed reactor using the newly developed nano-NiO/γ-Al<sub>2</sub>O<sub>3</sub> catalyst. The results indicated that the nano-NiO/γ-Al<sub>2</sub>O<sub>3</sub> catalyst had greater activity for the cracking of tar in vapor and of hydrocarbons and a higher hydrogen yield than the calcined dolomite in catalytic steam gasification of palm oil wastes. Meanwhile, a series of experiments have been performed to explore the effects of temperature, steam to biomass ratio (S/B) and biomass particle size on gas composition and gas yield. The experiments demonstrated that temperature was the most important factor in this process, higher temperature contributed to more hydrogen production and gas yield. Compared with biomass catalytic gasification, the introduction of steam improved gas quality and yield, the optimal value of S/B was found to be 1.33 under the present operating condition. It was also shown that a smaller particle was more favorable for gas quality and yield. [C1011]

#### **"The synthesis of combinational logic to generate probabilities"**

As CMOS devices are scaled down into the nanometer regime, concerns about reliability are mounting. Instead of viewing nano-scale characteristics as an impediment, technologies such as PCMOS exploit them as a source of randomness. The technology generates random numbers that are used in probabilistic algorithms. With the PCMOS approach, different voltage levels are used to generate different probability values. If many different probability values are required, this approach becomes prohibitively expensive. In this work, we demonstrate a novel technique for synthesizing logic that generates new probabilities from a given set of probabilities. Three different scenarios are considered in terms of whether the given probabilities can be duplicated and whether there is freedom to choose them. In the case that the given probabilities cannot be duplicated and are predetermined, we provide a solution that is FPGA-mappable. In the case that the given probabilities cannot be duplicated but can be freely chosen, we provide an optimal choice. In the case that the given probabilities can be duplicated and can be freely chosen, we demonstrate how to generate arbitrary decimal probabilities from small sets—a single probability or a pair of probabilities—through combinational logic. [C1012]

#### **"In-situ single cell manipulation via nanorobotic manipulation system inside E-SEM"**

We performed in-situ single cell (W303) manipulation with force measurement inside the environment-SEM. The mechanical end effector was fabricated from a commercial AFM cantilever by FIB etching. The end effector was assembled to the nanorobotic manipulation system which can realize controlling the position at the nanometer scale. The releasing, sliding and rolling of single cell on a substrate were achieved by controlling the humidity condition inside E-SEM. The influence of humidity to the single cell manipulation inside E-SEM was also discussed for the first time. To our knowledge, it is the first time to manipulate single cell with sliding and rolling movements inside E-SEM. [C1013]

#### **"Development of biodegradable scaffolds by leaching self-assembled magnetic sugar particles"**

Technologies to develop scaffolds with controlled diameter and high porosity have great significance in tissue engineering. We have fabricated biodegradable 2D and 3D scaffolds with ordered array of pores by casting polymer on self-assembled d-fructose (sugar) microspheres. First, ferrite microparticles were encapsulated in sugar spheres to make them become magnetized. After sieving magnetic sugar particles, those diameter-



controlled particles were attracted by a magnet to form a self-assembled template for polymer casting. After removal of sugar particles, ordered array of pores were generated on the surface of sheet-like scaffolds. Ordered pores are also generated in 3D tubular scaffolds by using magnetic force and viscoelasticity of PVA solution. It was confirmed that MSPs leaching method makes it possible to make high porous scaffolds in spite of the thickness of scaffold and the porosity is homogeneous. Finally, the biocompatibility of the developed scaffold was confirmed by the viability of human umbilical vein endothelial cells. [C1014]

### "Optimization of Nanoelectronic Systems Reliability Under Massive Defect Density Using Distributed R-fold Modular Redundancy (DRMR)"

The theoretical analysis of R-fold modular redundancy with distributed voters -- distributed R-fold modular redundancy, in terms of reliability is presented for the first time to the best of author's knowledge. This technique is compared in terms of resistance to massive levels of defect density expected in future nano-devices to R-fold modular redundancy with a single voter, cascaded R-fold modular redundancy and NAND multiplexing. Optimal partition size analysis and redundancy optimization of distributed R-fold modular redundancy technique has been performed for the first time in the context of a large-scale system. The optimal window of application of different fault-tolerant techniques with respect to defect density is presented as a way to find the optimum design trade-off between the reliability and power/area. [C1015]

### "A compact, nano-power CMOS action potential detector"

Real time action potential (AP) detection is an important requirement for development of fully implantable neuroprosthetic devices. We present an ultra low-power CMOS analog circuit for detection of APs embedded in a noisy signal. The proposed strategy isolates APs by detecting subsequently a positive and a negative spike of each AP. An AP is detected only if the positive spike is detected within a short period of time after the negative spike was detected. The proposed circuit has been designed to be implemented in AMIS 0.35  $\mu\text{m}$  technology (I3T80) and has been verified in Cadence using RF spectre. The final circuit operates from a 1-V supply and consumes only 1.5 nA. The detector is verified by means of simulations with synthetic neural waveforms and is able to successfully detect APs in noisy signals. [C1016]

### "Defect-Tolerant Logic Mapping on Nanoscale Crossbar Architectures and Yield Analysis"

Crossbar architectures are promising in the emerging nanoelectronic environment. However, fabrication processes for nano-scale circuits introduce numerous defects. Logic mapping on these defective nanofabrics thus emerges as a fundamental challenge. We establish a mathematical model for the logic mapping problem, followed by a probabilistic analysis to gain yield information. Since the most challenging part of the problem is the exponential runtime in searching for a solution, we examine the practical perspective of yield where a runtime limit is imposed. Yield improvement can be achieved through one of two ways: adding hardware redundancy by increasing crossbar size or allowing longer runtime. It turns out that correlations in the mapping solution space play an essential role on the complexity of the problem. Therefore, developing effective mechanisms to improve yield requires insights and analysis on correlations in the solution space. The analysis provided in this paper reveals the following points. Even though yield can always be improved through increasing crossbar size, the improvement gained by increasing crossbar size has a theoretical upperbound when a runtime limit is imposed. Consequently, there exists an optimal size for a crossbar to improve yield effectively within a runtime limit. Last but not least, for large-sized logic functions, longer runtime can be invested to improve yield significantly. [C1017]

### "A Web-Based Platform for Nanoscale Non-classical Device Modeling and Circuit Performance Simulation"

This paper describes a web-based platform for nanoscale non-classical device modeling and circuit simulation, especially for non-classical CMOS device compact modeling and circuit performance prediction. This platform is based on program libraries, including model code files. We use SPICE as circuit simulation framework, and the Verilog-A as model design language. Based on the user input deck content, running embedding device and circuit programs, the platform produces several types of device characteristics output such as data texts and graphs on the web page for analysis, according to the simulation results and users' requests. Some nanoscale device modeling examples and the circuit simulation cases are demonstrated by the means of the platform configures and function application. It is shown that not only does this kind of platform address problems arising from the dependence on computer operating system of modeling and simulation software, the complexity of software and program update, but also helps researchers focus on their research on device physics and circuit design, display their research results and share latest research achievements or new technology online, which will accelerate the development of device modeling and circuit design technology in turn. [C1018]



### "Local stiffness evaluation for alive *C. elegans* by Environmental-SEM nanorobotic manipulation system"

In this paper, the local stiffness of alive *Caenorhabditis elegans* (*C. elegans*) is evaluated by environmental-scanning electron microscope (E-SEM) nanorobotic manipulation system. The local and surface stiffness of *C. elegans* is important to evaluate to inject or insert micro-nano probes for gene-deliver or electrophysiologic applications. At first, we observe their fine structures by E-SEM system directly; without any drying or dyeing processes. The viability of *C. elegans* inside E-SEM is determined from the motion of *C. elegans* before and after setting inside the E-SEM. The local stiffness of *C. elegans* is evaluated from the deformation area by applying the forces with nanoprobe. The nanoprobe was fabricated by focus ion beam (FIB) etching at the tip of atomic force microscope (AFM) cantilever. The measurement position can arbitrarily be controlled by the nanomanipulator under E-SEM observation. The local stiffness distribution of *C. elegans* was evaluated on its head, body (on/around alae) and tail. From the experimental results, the measured rigidity on lateral alae was higher than it around lateral alae. This local stiffness measurement information is important for nano-surgery, gene-deliver or electrophysiologic applications and novel cell diagnosis. [C1019]

### "Efficient 2DMesh Network on Chip (NoC) Considering GALS Approach"

State of the art VLSI systems are characterised by their small, deca-nano feature size. In order to accommodate the complexity and scalability, a new design paradigm, system on chip (SoC) has been introduced. Performance and power of giga-scale SoC is ever more communication-dominated. However typical SoC communication infrastructure is based in standard buses and protocols which are difficult to scale to large systems. To solve this problem the Network on Chip (NoC) design paradigm has been introduced, where nodes communicate by exchanging packets through an interconnection network, which consists of routers and networks interfaces. The routers provide reliable data transfer. The network interfaces implement, via connections, high level services, such as transaction ordering, throughput and latency guarantees, and end-to-end flow control. In this research a 2D mesh node communication architecture of NoC is designed and simulated applying the GALS approach. A set of algorithms are also provided for these purpose. [C1020]

## СПИСОК ЛИТЕРАТУРЫ

- C1. Segev M. Complex nonlinear opto-fluidics: Controlling flow with light and vice-versa. / Segev M., Lamhot Y., Greenfield E., Barak A., Szameit A., Nemirovsky J., Rotschild C. // 2011 IEEE Winter Topicals (WTM). - Keystone, CO, USA, 10-12 Jan. 2011. - P. 107. ↑
- C2. Banerjee S. Variation-Aware TED-Based Approach for Nano-CMOS RTL Leakage Optimization. / Banerjee S., Mathew J., Pradhan D.K., Mohanty S.P., Ciesielski M. // 2011 24th International Conference on VLSI Design (VLSI Design). - Chennai, 2-7 Jan. 2011. - P. 304-309. ↑
- C3. Hoshino Takayuki. Electron beam direct drawing on living cell. / Hoshino Takayuki, Morishima Keisuke. // 2011 IEEE 24th International Conference on Micro Electro Mechanical Systems (MEMS). - Cancun, Mexico, 23-27 Jan. 2011. - P. 241-244. ↑
- C4. Zamani M. Variation-aware logic mapping for crossbar nano-architectures. / Zamani M., Tahoori M.B. // 2011 16th Asia and South Pacific Design Automation Conference (ASP-DAC). - Yokohama, 25-28 Jan. 2011. - P. 317-322. ↑
- C5. Reif John H. Keynote: DNA-based molecular devices. 2011 IEEE 1st International Conference on Computational Advances in Bio and Medical Sciences (ICCABS). - Orlando, FL, USA, 3-5 Feb. 2011. - P. 3. ↑
- C6. Moghadam A. T. Plasmonic low pass filter by nano rods embedded in metal-insulator-metal waveguides. / Moghadam A. T., Mirtaheeri S. A., Abrishamian M.S. // 2011 IEEE Winter Topicals (WTM). - Keystone, CO, USA, 10-12 Jan. 2011. - P. 5-6. ↑
- C7. Kimura Daichi. Nano-level 3-D shape measurement system using 3-wavelength LED light interference fringes. / Kimura Daichi, Hata Sheiji, Hayashi Jun-ichiro, Iwamoto Masakatsu, Morimoto Shigeaki, Kobayashi Hiroaki. // 2011 17th Korea-Japan Joint Workshop on Frontiers of Computer Vision (FCV). - Ulsan, Korea



(South), 9-11 Feb. 2011. - P. 1-6. ↑

**C8.** Shen C.W. A novel three-dimensional micro supercapacitor using self-support nano composite materials. / Shen C.W., Wang X.H., Zhang W.F., Kang F.Y., Du C. // 2011 IEEE 24th International Conference on Micro Electro Mechanical Systems (MEMS). - Cancun, Mexico, 23-27 Jan. 2011. - P. 1285-1288. ↑

**C9.** Mohan R. Energy-efficient biotelemetry system with Nano IP. / Mohan R., Baranidaran P., Sudha K. // 2011 National Conference on Innovations in Emerging Technology (NCOIET). - Erode, India, 17-18 Feb. 2011. - P. 67-70. ↑

**C10.** Khumpuang S. Novel conductive polymer micro-spring contact array for large area woven electronic textile. / Khumpuang S., Ohtomo A., Shibayama N., Miyake K., Itoh T. // 2011 IEEE 24th International Conference on Micro Electro Mechanical Systems (MEMS). - Cancun, Mexico, 23-27 Jan. 2011. - P. 296-299. ↑

**C11.** Yu H.T. Functionalized mesoporous thin-film directly self-assembled on resonant-cantilevers for batch-producible chemical sensors. / Yu H.T., Xu P.C., Xu T.G., Li Xinxin. // 2011 IEEE 24th International Conference on Micro Electro Mechanical Systems (MEMS). - Cancun, Mexico, 23-27 Jan. 2011. - P. 873-876. ↑

**C12.** Pandit S. Modeling the Effect of Gate Fringing and Dopant Redistribution on the Inverse Narrow Width Effect of Narrow Channel Shallow Trench Isolated MOSFETs. / Pandit S., Sarkar C.K. // 2011 24th International Conference on VLSI Design (VLSI Design). - Chennai, 2-7 Jan. 2011. - P. 195-200. ↑

**C13.** Liu Zehua. Removal of Indoor Pollutants by Nano TiO<sub>2</sub>/beta-Cyclodextrin Coated Paper under UV Irradiation. / Liu Zehua, Yan An, Miao Ranran. // 2010 4th International Conference on Bioinformatics and Biomedical Engineering (iCBBE). - Chengdu, 18-20 June 2010. - P. 1-4. ↑

**C14.** Hong-bin Yang. Preparation of Doped Nano-TiO<sub>2</sub> by Sol-Gel Method and the study on Its Photocatalytic Performance. / Hong-bin Yang, Wen ke Wang, Xiu-yan Jing, Sheng-ke Yang. // 2010 4th International Conference on Bioinformatics and Biomedical Engineering (iCBBE). - Chengdu, 18-20 June 2010. - P. 1-4. ↑

**C15.** Vatajelu E. I. Statistical analysis of SRAM parametric failure under supply voltage scaling. / Vatajelu E. I., Figueras J. // 2010 IEEE International Conference on Automation Quality and Testing Robotics (AQTR). - Cluj-Napoca, Romania, 28-30 May 2010. - Vol. 2. - P. 1-6. ↑

**C16.** Ahmad I. Robust H<sup>∞</sup> control of a scanning tunneling microscope under parametric uncertainties. / Ahmad I., Voda A., Besançon G. // 2010 American Control Conference (ACC). - Baltimore, MD, June 30 2010-July 2 2010. - P. 6555-6560. ↑

**C17.** Wang Q.X. Quantitative strain analysis for advanced CMOS technology by Nano Beam Diffraction. / Wang Q.X., Zhu J., Du A.Y., Liu J.P., Hua Y.N. // 2010 17th IEEE International Symposium on the Physical and Failure Analysis of Integrated Circuits (IPFA). - Singapore, 5-9 July 2010. - P. 1-3. ↑

**C18.** Fregene K. Dynamics and control of a biomimetic single-wing nano air vehicle. / Fregene K., Bolden C.L. // 2010 American Control Conference (ACC). - Baltimore, MD, June 30 2010-July 2 2010. - P. 51-56. ↑

**C19.** Dong-Chul Kim. Learning Proteomic Network Structure by a New Hill Climbing Algorithm. / Dong-Chul Kim, Gao J., Chin-Rang Yang. // 2010 IEEE International Conference on Bioinformatics and BioEngineering (BIBE). - Philadelphia, PA, May 31 2010-June 3 2010. - P. 191-196. ↑

**C20.** Wen Zhao. Study of size effect on the conductivity of nano-silver colloids. / Wen Zhao, Luhai Li, Luobu Danzeng. // 2010 International Conference on Microwave and Millimeter Wave Technology (ICMMT). - Chengdu, 8-11 May 2010. - P. 1919-1921. ↑

**C21.** Xiangying Deng. Five-beam Interference Pattern Model for laser interference lithography. / Xiangying Deng, Zhen Hu, Guowei Xiu, Dayou Li, Yong Yue, Zhengxun Song, Zhankun Weng, Jia Xu, Zuobin Wang. // 2010 IEEE International Conference on Information and Automation (ICIA). - Harbin, 20-23 June 2010. - P. 1208-1213. ↑

**C22.** Braun C. Algorithm-based fault tolerance for many-core architectures. / Braun C., Wunderlich H.-J. // 2010 15th IEEE European Test Symposium (ETS). - Praha, 24-28 May 2010. - P. 253. ↑

**C23.** Simsir M.O. NanoV: Nanowire-based VLSI design. / Simsir M.O., Jha N.K. // 2010 IEEE/ACM



International Symposium on Nanoscale Architectures (NANOARCH). - Anaheim, CA, 17-18 June 2010. - P. 53-58. ↑

C24. Xiaowen Wu. UNION: A unified inter/intra-chip optical network for chip multiprocessors. / Xiaowen Wu, Yaoyao Ye, Wei Zhang, Weichen Liu, Nikdast M., Xuan Wang, Jiang Xu. // 2010 IEEE/ACM International Symposium on Nanoscale Architectures (NANOARCH). - Anaheim, CA, 17-18 June 2010. - P. 35-40. ↑

C25. Kawamura F. Synthesis of cubic-GaN nanoparticles using the Na flux method: A novel use for the ultra-high pressure apparatus. / Kawamura F., Taniguchi T. // 2010 International Conference on Indium Phosphide & Related Materials (IPRM). - Kagawa, May 31 2010-June 4 2010. - P. 1-4. ↑

C26. Zhu Tao. Toluene Removal Using Non-Thermal Plasma Technology Coupled with Nano-Ba<sub>0.8</sub>Sr<sub>0.2</sub>Zr<sub>0.1</sub>Ti<sub>0.9</sub>O<sub>3</sub>. / Zhu Tao, Xu Dongyao, Shu Xinqian, He Xuwen, Li Xiao. // 2010 4th International Conference on Bioinformatics and Biomedical Engineering (ICBBE). - Chengdu, 18-20 June 2010. - P. 1-4. ↑

C27. Moses L.B. Regulating beyond nanotechnology do nano-specific problems require nano-specific solutions?. 2010 IEEE International Symposium on Technology and Society (ISTAS). - Wollongong, NSW, 7-9 June 2010. - P. 68-75. ↑

C28. Caloz C. Recent advances in micro-structured electric and nano-structured magnetic microwave metamaterials. / Caloz C., Carignan L., Boucher V., Kodaera T., Couture S., Parsa A., Menard D., Yelon A. // 2010 IEEE MTT-S International Microwave Symposium Digest (MTT). - Anaheim, CA, USA, 23-28 May 2010. - P. 1. ↑

C29. Hai-Gang Yang. Overview: Emerging technologies on giga-scale FPGA implementat. Proceedings of 2010 IEEE International Symposium on Circuits and Systems (ISCAS). - Paris, May 30 2010-June 2 2010. - P. 1428-1431. ↑

C30. Gui Liu. Configurable MCPW based inductor for mm-wave circuits and systems. / Gui Liu, Berenguer R., Akhiyat A., Kamtikan K., Yang Xu. // Proceedings of 2010 IEEE International Symposium on Circuits and Systems (ISCAS). - Paris, May 30 2010-June 2 2010. - P. 1113-1116. ↑

C31. Baoqing Xiao. Effect of samarium dopant on photocatalytic activity of TiO<sub>2</sub> nano-particle for the degradation of reactive orange 4. 2010 International Conference on Mechanic Automation and Control Engineering (MACE). - Wuhan, 26-28 June 2010. - P. 1789-1793. ↑

C32. Azam T. Robust low power design in nano-CMOS technologies. / Azam T., Dimming D.R.S. // Proceedings of 2010 IEEE International Symposium on Circuits and Systems (ISCAS). - Paris, May 30 2010-June 2 2010. - P. 2466-2469. ↑

C33. Sotiriadis P.P. All-digital frequency and clock synthesis architectures from a signals and systems perspective, current state and future directions. Proceedings of 2010 IEEE International Symposium on Circuits and Systems (ISCAS). - Paris, May 30 2010-June 2 2010. - P. 233-236. ↑

C34. Heng Kuang. A formal specification of fault-tolerance in prospecting asteroid mission with Reactive Autonomie Systems Framework. / Heng Kuang, Ormandjieva O., Klasa S., Bentahar J. // 2010 21st IEEE International Conference on Application-specific Systems Architectures and Processors (ASAP). - Rennes, 7-9 July 2010. - P. 99-106. ↑

C35. Bobba S. Design of a CNFET array for sensing and control in P450 based biochips for multiple drug detection. / Bobba S., Carrara S., De Micheli G. // Proceedings of 2010 IEEE International Symposium on Circuits and Systems (ISCAS). - Paris, May 30 2010-June 2 2010. - P. 1711-1714. ↑

C36. Camuc. On scalable spiking convnet hardware for cortex-like visual sensory processing systems. / Camuc, as-Mesa L., Perez-Carrasco J.A., Zamarrec, o-Ramos C., Serrano-Gotarredona T., Linares-Barranco B. // Proceedings of 2010 IEEE International Symposium on Circuits and Systems (ISCAS). - Paris, May 30 2010-June 2 2010. - P. 249-252. ↑

C37. Ogino A. Protein grafting onto chitosan surface using low temperature microwave plasma treatment. / Ogino A., Shao Z., Noguchi S., Nagatsu M. // 2010 Abstracts IEEE International Conference on Plasma Science. - Norfolk, VA, USA, 20-24 June 2010. - P. 1. ↑



- C38.** Ke Pei. Analysis of SOA-based middleware service layers for polynary resources SoC. / Ke Pei, Gang Zhang, Zhong-Jie Zhang. // 2010 3rd International Conference on Information Sciences and Interaction Sciences (ICIS). - Chengdu, China, 23-25 June 2010. - P. 502-507. ↑
- C39.** Chen Yaliang. Absorbed-specimen current imaging implementation and characterization in nano-prober for resistive interconnects isolation in 45-nm silicon-on-insulator microprocessors. / Chen Yaliang, Lim Soon-Huat, Narang V., Chin J.M. // 2010 17th IEEE International Symposium on the Physical and Failure Analysis of Integrated Circuits (IPFA). - Singapore, 5-9 July 2010. - P. 1-5. ↑
- C40.** Wen Pin Lin. Physical failure analysis cases by Electron Beam Absorbed Current & Electron Beam Induced Current detection on nano-probing SEM system. / Wen Pin Lin, Hsiu Ju Chang. // 2010 17th IEEE International Symposium on the Physical and Failure Analysis of Integrated Circuits (IPFA). - Singapore, 5-9 July 2010. - P. 1-4. ↑
- C41.** Li Guang. Six-DOF maglev nano precision microstage development. / Li Guang, Zhu Yu, Zhang Ming, Duan Guanghong, Tomizuka M. // 2010 International Conference on Mechanic Automation and Control Engineering (MACE). - Wuhan, 26-28 June 2010. - P. 938-941. ↑
- C42.** Yu Fu. Research on the rheological characteristics of layered nano-montmorillonite modified asphalt binder. / Yu Fu, Shaopeng Wu, Jun Han, Jianying Yu. // 2010 International Conference on Mechanic Automation and Control Engineering (MACE). - Wuhan, 26-28 June 2010. - P. 1382-1384. ↑
- C43.** Xu Lin. Research on nano mechanical properties and ultra-structure of yeast cells. / Xu Lin, Ding Jianning, Gao Jing, Li Boquan, Lin Na, Cheng Guanggui. // 2010 International Conference on Mechanic Automation and Control Engineering (MACE). - Wuhan, 26-28 June 2010. - P. 2362-2365. ↑
- C44.** Li Jian-fen. Development of the supported nickel-based catalysts and application in pyrolyzing biomass. / Li Jian-fen, Liu Jian-jun, Xiao Bo, Zhuo Han-fen, Lao shi-yan, Yan Rong. // 2010 International Conference on Mechanic Automation and Control Engineering (MACE). - Wuhan, 26-28 June 2010. - P. 5160-5163. ↑
- C45.** Inoue F. Conformal deposition of electroless barrier and seed layers in TSV with Au nano particle catalyst. / Inoue F., Yokoyama T., Miyake H., Tanaka S., Yamamoto K., Shingubara S. // 2010 International Interconnect Technology Conference (IITC). - Burlingame, CA, 6-9 June 2010. - P. 1-2. ↑
- C46.** Gan Qiaoqiang. What can be observed from surface plasmon spectral interference?. / Gan Qiaoqiang, Gao Yongkang, Zhu Lin, Bartoli Filbert J. // 2010 Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS). - San Jose, CA, USA, 16-21 May 2010. - P. 1-2. ↑
- C47.** Wunderle B. Advances in thermal interface technology: mono-metal interconnect formation, processing and characterisation. / Wunderle B., Klein M., Dietrich L., Ras M.A., Mrossko R., May D., Schacht R., Oppermann H., Michel B., Reichl H. // 2010 12th IEEE Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (ITherm). - Las Vegas, NV, 2-5 June 2010. - P. 1-10. ↑
- C48.** Normatov Alex. Nano-coupling and enhancement in plasmonic conical needle. / Normatov Alex, Berkovitch Nikolai, Ginzburg Pavel, Lerman Gilad M., Yanai Avner, Levy Uriel, Orenstein Meir. // 2010 Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS). - San Jose, CA, USA, 16-21 May 2010. - P. 1-2. ↑
- C49.** Kozlov Maxim. Emitter of continues-wave, ultra coherent, extreme ultraviolet radiation that is driven by low-power laser. / Kozlov Maxim, Carmon Tal, Schwefel Harald G. L., Cohen Oren. // 2010 Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS). - San Jose, CA, USA, 16-21 May 2010. - P. 1-2. ↑
- C50.** Pattanaik Manisha. Ground bounce noise reduction of low leakage 1-bit nano-CMOS based full adder cells for mobile applications. / Pattanaik Manisha, Varaprasad Muddala V. D. L., Khan Fazal Rahim. // 2010 Intl Conf on Electronic Devices, Systems and Applications (ICEDSA). - Kuala Lumpur, Malaysia, 11-14 April 2010. - P. 31-36. ↑
- C51.** Andre F. 7.1: TWT and X-Ray devices based on carbon nano-tubes. / Andre F., Ponard P., Rozier Y., Bourat C., Gangloff L., Xavier S. // 2010 IEEE International Vacuum Electronics Conference (IVEC). - Monterey, CA, 18-20 May 2010. - P. 83-84. ↑



- C52.** Fischer M. Design of a Multi-mission Satellite Ground Station for Education and Research. / Fischer M., Scholtz A.L. // 2010 Second International Conference on Advances in Satellite and Space Communications (SPACOMM). - Athens, 13-19 June 2010. - P. 58-63. ↑
- C53.** Neema V. Novel circuit technique for reduction of active drain current in series/parallel PMOS transistors stack. / Neema V., Chouhan S.S., Tokekar S. // 2010 Intl Conf on Electronic Devices, Systems and Applications (ICEDSA). - Kuala Lumpur, 11-14 April 2010. - P. 368-372. ↑
- C54.** Bychkovsky V. Piezoresistive cantilever for mechanical force sensors. / Bychkovsky V., Lobur M. // 2010 Proceedings of VIth International Conference on Perspective Technologies and Methods in MEMS Design (MEMSTECH). - Lviv, 20-23 April 2010. - P. 87-88. ↑
- C55.** Xiaolong Hu. Mid-infrared single-photon detection using superconducting nanowires integrated with nano-antennae. / Xiaolong Hu, Marsili F., Najafi F., Berggren K.K. // 2010 Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS). - San Jose, CA, 16-21 May 2010. - P. 1-2. ↑
- C56.** Lyskouski V. Ternary TiMeX<sub>2</sub> compounds for MEMS application. / Lyskouski V., Nelayev V. // 2010 Proceedings of VIth International Conference on Perspective Technologies and Methods in MEMS Design (MEMSTECH). - Lviv, 20-23 April 2010. - P. 250-253. ↑
- C57.** Romanyuk A. Development an ontology of Microelectromechanical Systems (MEMS) and nano-electromechanical systems (NEMS). 2010 Proceedings of VIth International Conference on Perspective Technologies and Methods in MEMS Design (MEMSTECH). - Lviv, 20-23 April 2010. - P. 242. ↑
- C58.** Pe'er Avi. Sum-frequency generation as an ultrafast quantum detector for Heisenberg scaled phase measurement. 2010 Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS). - San Jose, CA, USA, 16-21 May 2010. - P. 1-2. ↑
- C59.** Lin Q. Force-mediated parametric generation in nano-optomechanical structures. / Lin Q., Rosenberg J., Chang D., Painter O. // 2010 Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS). - San Jose, CA, USA, 16-21 May 2010. - P. 1-2. ↑
- C60.** Kim Taek. Effective suppression of in localization and piezoelectric field in InGaN multi quantum-wells by growth on nano scale pyramidal facets. / Kim Taek, Kim Jusung, Yang Moonseung, Lee Sangmoon, Park Yongsoo, Chung Uin. // 2010 Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS). - San Jose, CA, USA, 16-21 May 2010. - P. 1-2. ↑
- C61.** Young Ian A. Integration of nano-photonic devices for CMOS chip-to-chip optical I/O. / Young Ian A., Block Bruce, Reshotko Miriam, Chang Peter. // 2010 Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS). - San Jose, CA, USA, 16-21 May 2010. - P. 1-2. ↑
- C62.** Olson R.J. Optimization of Micro and Nano Research and Development Fabrication Operations. / Olson R.J., Hawkins W.G., Piacente P.A., Frank R., Deluca J.A., Douglas L.R., Trant G.P. // 2010 18th Biennial University/Government/Industry Micro/Nano Symposium (UGIM). - West Lafayette, IN, June 28 2010-July 1 2010. - P. 1. ↑
- C63.** Ray B. Performance Improvement of Polymer Based Solar Cell by Ordered Nano-Morphology. / Ray B., Khan M.R., Alam M.A. // 2010 18th Biennial University/Government/Industry Micro/Nano Symposium (UGIM). - West Lafayette, IN, June 28 2010-July 1 2010. - P. 1-3. ↑
- C64.** Yuan C.Y. Sustainable scale-up studies of Atomic Layer Deposition for microelectronics manufacturing. / Yuan C.Y., Yangping Sheng. // 2010 IEEE International Symposium on Sustainable Systems and Technology (ISSST). - Arlington, VA, 17-19 May 2010. - P. 1-6. ↑
- C65.** Diadiuk V. Fabrication Facilities and Operational Model at MIT's Microsystems Technology Labs. 2010 18th Biennial University/Government/Industry Micro/Nano Symposium (UGIM). - West Lafayette, IN, June 28 2010-July 1 2010. - P. 1-3. ↑
- C66.** Madadi I. Multi-walled carbon nanotube impedance. / Madadi I., Aghababa H., Forouzandeh B. // 2010 IEEE International Conference on IC Design and Technology (ICICDT). - Grenoble, 2-4 June 2010. - P. 198- ↑



202.

**C67.** Nogami T. CVD Co and its application to Cu damascene interconnections. / Nogami T., Maniscalco J., Madan A., Flaitz P., DeHaven P., Parks C., Tai L., Lawrence B.S., Davis R., Murphy R., Shaw T., Cohen S., Hu C.-K., Cabral C., Chiang S., Kelly J., Zaitz M., Schmatz J., Choi S., Tsumura K., Penny C., Chen H.-C., Canaperi D., Vo T., Ito F., Straten O., Simon A., Rhee S.-H., Kim B.-Y., Bolom T., Ryan V., Ma P., Ren J., Aubuchon J., Fine J., Kozlowski P., Spooner T., Edelstein D. // 2010 International Interconnect Technology Conference (IITC). - Burlingame, CA, 6-9 June 2010. - P. 1-3. ↑

**C68.** Buckhanan W.L. Bridging the HPC Processor-Memory Gap with Quilt Packaging. / Buckhanan W.L., Niemier M., Bernstein G.H. // 2010 18th Biennial University/Government/Industry Micro/Nano Symposium (UGIM). - West Lafayette, IN, June 28 2010-July 1 2010. - P. 1-3. ↑

**C69.** Hmelo A.B. The VINSE Core Laboratories: Opportunities, Challenges and Lessons Learned at Year 6. 2010 18th Biennial University/Government/Industry Micro/Nano Symposium (UGIM). - West Lafayette, IN, June 28 2010-July 1 2010. - P. 1-4. ↑

**C70.** Shoucai Yuan. Carbon Nanotubes Flat Panel Displayer Fabricated and Its High Voltage Drive Circuits Designed. / Shoucai Yuan, Shouhuai Yuan, Yingfang Hong, Changchun Zhu. // 2010 Symposium on Photonics and Optoelectronic (SOPO). - Chengdu, 19-21 June 2010. - P. 1-3. ↑

**C71.** Bilotti Filiberto. Metamaterials in antenna design and technology. / Bilotti Filiberto, Vegni Lucio. // 2010 Proceedings of the Fourth European Conference on Antennas and Propagation (EuCAP). - Barcelona, Spain, 12-16 April 2010. - P. 1-3. ↑

**C72.** Jin-Wang Yu. An Study on Laser Propagation Characteristics of Skin in Vivo. / Jin-Wang Yu, Changshui Chen, Songhao Liu, Xiangrong Liu, Hanchuan Huang, Yifan Jiang, Xiaomei Liu. // 2010 Symposium on Photonics and Optoelectronic (SOPO). - Chengdu, 19-21 June 2010. - P. 1-4. ↑

**C73.** Yanning Yang. Influence of Temperature and Vacuum on Nano-Diamond Filed Emission. / Yanning Yang, Zhiyong Zhang, Jiangni Yun, Weihu Zhang, Fuchun Zhang. // 2010 Symposium on Photonics and Optoelectronic (SOPO). - Chengdu, 19-21 June 2010. - P. 1-4. ↑

**C74.** Akyildiz Ian F. Propagation models for nanocommunication networks. / Akyildiz Ian F., Jornet Josep Miquel, Pierobon Massimiliano. // 2010 Proceedings of the Fourth European Conference on Antennas and Propagation (EuCAP). - Barcelona, Spain, 12-16 April 2010. - P. 1-5. ↑

**C75.** Curto A. G. A nano-optical Yagi-Uda antenna driven by single emitters. / Curto A. G., Taminiau T. H., Volpe G., Kreuzer M., Quidant R., van Hulst N. F. // 2010 Proceedings of the Fourth European Conference on Antennas and Propagation (EuCAP). - Barcelona, Spain, 12-16 April 2010. - P. 1. ↑

**C76.** Jornet Josep Miquel. Graphene-based nano-antennas for electromagnetic nanocommunications in the terahertz band. / Jornet Josep Miquel, Akyildiz Ian F. // 2010 Proceedings of the Fourth European Conference on Antennas and Propagation (EuCAP). - Barcelona, Spain, 12-16 April 2010. - P. 1-5. ↑

**C77.** Righini M. Nano-optical trapping by resonant optical antennas of Rayleigh particles and E-coli bacteria. / Righini M., Ghenuche P., Cherukulappurath S., Myroshnychenko V., de Abajo F. J. Garcia, Quidant R. // 2010 Proceedings of the Fourth European Conference on Antennas and Propagation (EuCAP). - Barcelona, Spain, 12-16 April 2010. - P. 1-4. ↑

**C78.** Hui Lee Teng. A study of the relationship between on-chip power distribution network voltage noise, charge per clock cycle, on-chip decoupling capacitance and clock jitter in a 40-nm field programmable gate array test chip. / Hui Lee Teng, Shishuang Sun, Man On Wong, Boyle P., Chee Seong Fong. // 2010 International Conference on Applications of Electromagnetism and Student Innovation Competition Awards (AEM2C). - Taipei, 11-13 Aug. 2010. - P. 75-79. ↑

**C79.** Huang G.M. Memristor system properties and its design applications to circuits such as nonvolatile memristor memories. / Huang G.M., Yenpo Ho, Peng Li. // 2010 International Conference on Communications, Circuits and Systems (ICCCAS). - Chengdu, 28-30 July 2010. - P. 805-810. ↑

**C80.** Gamrat C. Challenges and Perspectives of Computer Architecture at the Nano Scale. 2010 IEEE Computer Society Annual Symposium on VLSI (ISVLSI). - Lixouri, Kefalonia, 5-7 July 2010. - P. 8-10. ↑



- C81.** Niknahad M. Reliability Analysis and Improvement in Nano Scale Design. / Niknahad M., Huebner M., Becker J. // 2010 IEEE Computer Society Annual Symposium on VLSI (ISVLSI). - Lixouri, Kefalonia, 5-7 July 2010. - P. 299-303. ↑
- C82.** Tsao L.C. Effect of nano-TiO<sub>2</sub> addition on wettability and interfacial reactions of Sn<sub>0.7</sub>Cu composite solder/Cu solder joints. / Tsao L.C., Wang B.C., Chang C.W., Wu M.W. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 250-253. ↑
- C83.** Wenkai Tao. Reliability characterisation of Bi-modal high temperature stable Isotropic Conductive Adhesives. / Wenkai Tao, Si Chen, Xiaohua Liu, Huiwang Cui, Tianan Chen, Liu J. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 225-228. ↑
- C84.** Sommer J. Design of Low Loss Beam Forming Networks-supported by numerical simulations and material characterisation. / Sommer J., Gunner C., Uhlig P., Kulke R., Michel B. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 65-70. ↑
- C85.** Xiangyan Chen. Preparation of nano silver pastes applied in printed electronics. / Xiangyan Chen, Mingfei Sun, Fei Xiao. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 279-282. ↑
- C86.** Qianting. Computer simulation for electroluminescence efficiency and multi-peak structure of nano-porous oxidized silicon photodiode. / Qianting, Gujing, Cui Haoyang, Yujiaying. // 2010 3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT). - Chengdu, 9-11 July 2010. - Vol. 6. - P. 660-663. ↑
- C87.** Jianjun Liu. Fuel gas production from catalytic steam gasification of municipal solid wastes. / Jianjun Liu, Jianfen Li, Shiyao Liao. // 2010 International Conference on Environmental Science and Information Application Technology (ESIAT). - Wuhan, 17-18 July 2010. - Vol. 3. - P. 652-655. ↑
- C88.** Hong-Sik Shin. Improvement of junction characteristics of ultra shallow junction with boron-cluster implantation and Ni-silicide for nano-scale CMOS technology. / Hong-Sik Shin, Se-Kyung Oh, Min-Ho Kang, In-Shik Han, Hyuk-Min Kwon, Sang-Uk Park, Byung-Seok Park, Jung-Deuk Bok, Ga-Won Lee, Hi-Deok Lee. // 2010 Silicon Nanoelectronics Workshop (SNW). - Honolulu, HI, 13-14 June 2010. - P. 1-2. ↑
- C89.** Singh A.K. P1-18: I-V Characteristics of nanogap electrodes formed by thermally assisted electromigration. / Singh A.K., Rajput N.S., Banerjee A., Kulkarni V.N., Kumar J. // 2010 23rd International Vacuum Nanoelectronics Conference (IVNC). - Palo Alto, CA, 26-30 July 2010. - P. 64. ↑
- C90.** Guoting Li. Photocatalytic degradation of methylene blue by magnetically separable BiVO<sub>4</sub> supported on Fe<sub>3</sub>O<sub>4</sub> nanoparticles. / Guoting Li, Gangfu Song, Jing Chen, Meiya Zhu, Wong P.K. // 2010 International Conference on Environmental Science and Information Application Technology (ESIAT). - Wuhan, 17-18 July 2010. - Vol. 1. - P. 352-355. ↑
- C91.** Talghader J.J. Sensing inside explosions: Thermal history deduced from microparticle luminescence. 2010 Seventh International Conference on Networked Sensing Systems (INSS). - Kassel, 15-18 June 2010. - P. 169-170. ↑
- C92.** Xuening Fei. Preparation and photocatalytic activity of magnetic Fe<sub>3</sub>O<sub>4</sub>/TiO<sub>2</sub> photocatalyst. / Xuening Fei, Xiaojuan Xu, Guozhi Jia, Qiuli Li. // 2010 International Conference on Environmental Science and Information Application Technology (ESIAT). - Wuhan, 17-18 July 2010. - Vol. 1. - P. 227-229. ↑
- C93.** Peng Wen-li. Analysis on nano biomedical components of wood from Cinnamomum camphora by Py-GC/MS. 2010 International Conference on Environmental Science and Information Application Technology (ESIAT). - Wuhan, 17-18 July 2010. - Vol. 1. - P. 387-390. ↑
- C94.** Vassev E. Automated Test Case Generation of Self-Managing Policies for NASA Prototype Missions Developed with ASSL. / Vassev E., Hinchey M., Nixon P. // 2010 4th IEEE International Symposium on Theoretical Aspects of Software Engineering (TASE). - Taipei, 25-27 Aug. 2010. - P. 3-8. ↑



- C95.** Baba T. Progress in silicon photonics and recent activities in Asia. / Baba T., Yamada K. // 2010 15th Optoelectronics and Communications Conference (OECC). - Sapporo, 5-9 July 2010. - P. 10-13. ↑
- C96.** Fatikow S. Automated nanorobotic handling of bio- and nano-materials. / Fatikow S., Eichhorn V., Jasper D., Weigel-Jech M., Niewiera F., Krohs F. // 2010 IEEE Conference on Automation Science and Engineering (CASE). - Toronto, ON, 21-24 Aug. 2010. - P. 1-6. ↑
- C97.** {no data available}. Content list. 2010 IEEE Conference on Automation Science and Engineering (CASE). - Toronto, ON, 21-24 Aug. 2010. - P. 1-10. ↑
- C98.** Mengxing Ouyang. Performance of F-CNTs sensors towards ethanol vapor using different functional groups. / Mengxing Ouyang, Li W.J. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 928-931. ↑
- C99.** Yi-Ta Hsieh. Nano-patterned AlGaInP light-emitting diode based on UV-Kiss metal transfer technology. / Yi-Ta Hsieh, Chun-Hung Chen, Yung-Chun Lee, Xu-Feng Zeng, Shih-Chang Shei, Hung-Yi Lin. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 915-918. ↑
- C100.** Furuya K. Basic study of coupling on Si waveguides of grade separation by numerical analysis. / Furuya K., Sakakibara Y., Mori M. // 2010 15th Optoelectronics and Communications Conference (OECC). - Sapporo, 5-9 July 2010. - P. 708-709. ↑
- C101.** Chun-Hung Chen. Infrared-assisted and roller-based direct metal contact transfer technology for flexible polarizer. / Chun-Hung Chen, Te-Hui Yu, Yung-Chun Lee, Fei-Bin Hsiao. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 937-940. ↑
- C102.** Tsao L.C. Electrochemical behavior of a new Sn3.5Ag0.5Cu composite solder. / Tsao L.C., Lo T.T., Peng S.F., Chang S.Y. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 1013-1017. ↑
- C103.** Xianwen Liang. Dielectric properties of Ag@SiO2 /epoxy composite for embedded capacitor applications. / Xianwen Liang, Shuhui Yu, Suibin Luo, Zhiqiang Zhuang, Sun Rong. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 456-459. ↑
- C104.** Guangfu Zeng. Improving the humidity resistance of electronic packaging materials by micro-nano hierarchical structured silica. / Guangfu Zeng, Dayong Gui, Xin Miao, Jingfeng Hao, Jianhong Liu. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 170-175. ↑
- C105.** Niu Xiaoyan. Characterization of the creep constitutive behavior of SnAgCu solder in flip chip joints from the indentation creep testing. / Niu Xiaoyan, Shu Xuefeng. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 156-159. ↑
- C106.** Xin Li. Study on adhesive reliability of low-temperature sintered high power LED modules. / Xin Li, Xu Chen, Dun-Ji Yu, Guo-Quan Lu. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 1371-1376. ↑
- C107.** Xinhe Tang. Carbon nanotube enhanced thermally and electrically conductive adhesive for advanced packaging. / Xinhe Tang, Reiter W., Meyer A., Tse K.K.C., Hammel E. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 438-441. ↑
- C108.** Yuan Guozheng. Mechanical characterization of the IMC layer by using Nano-indentation tests. / Yuan Guozheng, Li Zhigang, Shu Xuefeng. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 1077-1079. ↑
- C109.** Li Zongshuo. Experimental research of micro-channel cooler. / Li Zongshuo, Wang Xiaojing, Wang Dianxiao, Wang Jia. // 2010 11th International Conference on Electronic Packaging Technology & High Density Packaging (ICEPT-HDP). - Xi'an, 16-19 Aug. 2010. - P. 1355-1358. ↑



- C110.** Jyi-Tsong Lin. Design theory and fabrication process of 90nm unipolar-CMOS. / Jyi-Tsong Lin, Hsuan-Hsu Chen, Kuan-Yu Lu, Chih-Hung Sun, Yi-Chuen Eng, Chih-Hao Kuo, Po-Hsieh Lin, Tung-Yen Lai, Fu-Liang Yang. // 2010 Silicon Nanoelectronics Workshop (SNW). - Honolulu, HI, 13-14 June 2010. - P. 1-2. ↑
- C111.** Jianping Guo. Power-on-reset circuit with power-off auto-discharging path for passive RFID tag ICs. / Jianping Guo, Weiwei Shi, Ka Nang Leung, Chiu Sing Choy. // 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 21-24. ↑
- C112.** {no data available}. Copyright page. 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 1. ↑
- C113.** Albrecht O. Towards an interactive knowledge transfer-The non-destructive evaluation knowledge-based system. / Albrecht O., Wolter K., Oppermann M. // 2010 33rd International Spring Seminar on Electronics Technology (ISSE). - Warsaw, 12-16 May 2010. - P. 488-493. ↑
- C114.** Kos. Application of silver nanoparticles to improve wettability of SnAgCu solder paste. / Kos, cielski M., Bukat K., Jakubowska M., Młoz, niak A. // 2010 33rd International Spring Seminar on Electronics Technology (ISSE). - Warsaw, 12-16 May 2010. - P. 473-477. ↑
- C115.** Purohit S. High performance digital circuit design using Ballistic Nano-electronics. / Purohit S., Ic,iguez-de-la-Torre I., Kaushal V., Margala M. // 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 264-267. ↑
- C116.** Aceves-Mijares M. Silicon sensor with high sensibility from 200 to 1100 nm using embedded silicon nano-particles. / Aceves-Mijares M., Di,az-Me,ndez A., Pedraza J., Rocha-Pe,rez J.M., Gallardo A., Go,mez E., Domi,nguez C. // 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 276-279. ↑
- C117.** Beg A. A composition-aware model for unreliable circuits. 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 853-856. ↑
- C118.** Niamat M. QCA design and implementation of SRAM based FPGA Configurable Logic Block. / Niamat M., Panuganti S., Raviraj T. // 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 837-840. ↑
- C119.** Nilsson P. Approaching green electronics: Power efficient arithmetic in nano-scale CMOS. 2010 International Conference on Green Circuits and Systems (ICGCS). - Shanghai, 21-23 June 2010. - P. 230-235. ↑
- C120.** Chatterjee A. Improving surface bipolar activity in thin gate oxide DE-NMOS-A critical HV I/O protection element for nano-meter scale technologies. / Chatterjee A., Pendharkar S., Gossner H., Duvvury C., Brewer F. // 2010 22nd International Symposium on Power Semiconductor Devices & IC's (ISPSD). - Hiroshima, 6-10 June 2010. - P. 307-310. ↑
- C121.** Dotan Yocheved. Comparing the robustness of fault-tolerant enhancements when applied to lookup tables and random logic for nano-computing. / Dotan Yocheved, Chen Orgad, Katz Gil. // 2010 21st IEEE International Conference on Application-specific Systems Architectures and Processors (ASAP). - Rennes, France, 7-9 July 2010. - P. 107-114. ↑
- C122.** Po-Tsang Huang. Energy-efficient techniques for circuit design in network-on-chip platforms. / Po-Tsang Huang, Wei Hwang. // 2010 International Conference on Green Circuits and Systems (ICGCS). - Shanghai, 21-23 June 2010. - P. 305-310. ↑
- C123.** Sand Matthias. Nano-technology aware investigations on fault-masking techniques in the presence of high fault probabilities. / Sand Matthias, Sieh Volkmar, Fey Dietmar. // 2010 International Conference on High Performance Computing and Simulation (HPCS). - Caen, France, June 28 2010-July 2 2010. - P. 181-187. ↑
- C124.** Hrdy R. Electrochemical transducer utilizing nanowires surface. / Hrdy R., Vorozhtsova M., Drbohlavova J., Prasek J., Hubalek J. // 2010 33rd International Spring Seminar on Electronics Technology (ISSE). - Warsaw, 12-16 May 2010. - P. 510-514. ↑
- C125.** Nathan A. Nanocrystalline silicon thin film transistors. 2010 International Kharkov Symposium on Physics



and Engineering of Microwaves, Millimeter and Submillimeter Waves (MSMW). - Kharkiv, 21-26 June 2010. - P. 1. ↑

**C126.** Semenenko V.L. Parametric instability of mobile elastic gate in tera- and nano- high electron mobility transistor. / Semenenko V.L., Leiman V.G., Arsenin A.V., Gladun A.D., Ryzhii V.I. // 2010 International Kharkov Symposium on Physics and Engineering of Microwaves, Millimeter and Submillimeter Waves (MSMW). - Kharkiv, 21-26 June 2010. - P. 1-3. ↑

**C127.** Basker V.S. A 0.063  $\mu\text{m}^2$  FinFET SRAM cell demonstration with conventional lithography using a novel integration scheme with aggressively scaled fin and gate pitch. / Basker V.S., Standaert T., Kawasaki H., Yeh C., Maitra K., Yamashita T., Faltermeier J., Adhikari H., Jagannathan H., Wang J., Sunamura H., Kanakasabapathy S., Schmitz S., Cummings J., Inada A., Lin C., Kulkarni P., Zhu Y., Kuss J., Yamamoto T., Kumar A., Wahl J., Yagishita A., Edge L.F., Kim R.H., Mclellan E., Holmes S.J., Johnson R.C., Levin T., Demarest J., Hane M., Takayanagi M., Colburn M., Paruchuri V.K., Miller R.J., Bu H., Doris B., McHerron D., Leobandung E., O'Neill J. // 2010 Symposium on VLSI Technology (VLSIT). - Honolulu, 15-17 June 2010. - P. 19-20. ↑

**C128.** Seiyon Kim. Silicon on replacement insulator (SRI) floating body cell (FBC) memory. / Seiyon Kim, Tseng R.J., Rachmady W., Ben Jin, Shah U., Ban I., Avci U.E., Chang P.L.D. // 2010 Symposium on VLSI Technology (VLSIT). - Honolulu, 15-17 June 2010. - P. 165-166. ↑

**C129.** Shuai Yuan. A probabilistic approach for on-line positioning in nano manipulations. / Shuai Yuan, Lianqing Liu, Zhidong Wang, Ning Xi, Yuechao Wang, Zaili Dong, Zhiyu Wang. // 2010 8th World Congress on Intelligent Control and Automation (WCICA). - Jinan, 7-9 July 2010. - P. 450-455. ↑

**C130.** Eneman G. High-mobility Si<sub>1-x</sub>Gex -channel PFETs: Layout dependence and enhanced scalability, demonstrating 90% performance boost at narrow widths. / Eneman G., Yamaguchi S., Ortolland C., Takeoka S., Witters L., Chiarella T., Favia P., Hikavvy A., Mitard J., Kobayashi M., Krom R., Bender H., Tseng J., Wang W., Vandervorst W., Loo R., Absil P.P., Biesemans S., Hoffmann T. // 2010 Symposium on VLSI Technology (VLSIT). - Honolulu, 15-17 June 2010. - P. 41-42. ↑

**C131.** Brockett T. GaAs nano-pillars for solar power absorption: Electromagnetic characterization. / Brockett T., Rajagopalan H., Rahmat-Samii Y. // 2010 IEEE Antennas and Propagation Society International Symposium (APSURSI). - Toronto, ON, 11-17 July 2010. - P. 1-4. ↑

**C132.** Shaker G. Low-cost antennas for mm-Wave sensing applications using inkjet printing of silver nanoparticles on liquid crystal polymers. / Shaker G., Tentzeris M., Safavi-Naeini S. // 2010 IEEE Antennas and Propagation Society International Symposium (APSURSI). - Toronto, ON, 11-17 July 2010. - P. 1-4. ↑

**C133.** Duval S. Ubiquity: Micro to Macro Ecosystems?. / Duval S., Woo W. // 2010 International Symposium on Ubiquitous Virtual Reality (ISUVR). - Gwangju, 7-10 July 2010. - P. 28-31. ↑

**C134.** Sheng-Po Wu. Design and fabrication of a low-power and nanoporous micro-hotplate for chemical sensor applications with high sensitivity. / Sheng-Po Wu, Yong-Sheng Huang, Chih-Cheng Lu, Jen-Tzong Jeng. // 2010 2nd International Conference on Mechanical and Electronics Engineering (ICMEE). - Kyoto, 1-3 Aug. 2010. - Vol. 2. - P. V2-131-V2-135-131. ↑

**C135.** Saxena V. Indirect compensation techniques for three-stage fully-differential op-amps. / Saxena V., Baker R.J. // 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 588-591. ↑

**C136.** Abdullah F. IDD scan test method for fault localization technique on CMOS VLSI failure analysis. / Abdullah F., Nayan N., Jamil M.M.A., Kamsin N. // 2010 IEEE International Conference on Semiconductor Electronics (ICSE). - Melaka, 28-30 June 2010. - P. 104-107. ↑

**C137.** Saxena V. Synthesis of higher-order K-Delta-1-Sigma modulators for wideband ADCs. / Saxena V., Baker R.J. // 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 1029-1032. ↑

**C138.** Farzeen S. An ultra-low power ring oscillator for passive UHF RFID transponders. / Farzeen S., Guoyan Ren, Chunhong Chen. // 2010 53rd IEEE International Midwest Symposium on Circuits and Systems (MWSCAS). - Seattle, WA, 1-4 Aug. 2010. - P. 558-561. ↑



- C139.** Chia V.K.F. Process tool cleanliness for clean manufacturing. 2010 IEEE/SEMI Advanced Semiconductor Manufacturing Conference (ASMC). - San Francisco, CA, 11-13 July 2010. - P. 79-83. ↑
- C140.** Wahab W.M.A. Low cost microstrip patch antenna array using planar waveguide technology for emerging millimeter-wave wireless communication. / Wahab W.M.A., Safavi-Naeini S., Busuioc D. // 2010 14th International Symposium on Antenna Technology and Applied Electromagnetics & the American Electromagnetics Conference (ANTEM-AMEREM). - Ottawa, ON, 5-8 July 2010. - P. 1-4. ↑
- C141.** Hashim M.R. Nanostructures of III-V semiconductor for photonic, electronic, and sensing applications back to basics. 2010 IEEE International Conference on Semiconductor Electronics (ICSE). - Melaka, 28-30 June 2010. - P. A9. ↑
- C142.** Bampi S. Heterogeneous integration: Beyond CMOS-coping with variability at the end of the CMOS roadmap. 2010 11th Latin American Test Workshop (LATW). - Pule del Este, 28-31 March 2010. - P. 1. ↑
- C143.** Chen Hai-chu. Study of proportion and fuzzy control method upon precision micro-flow valve. / Chen Hai-chu, Yang Hui, Zhang Hua, Zhang Rui-hua. // 2010 2nd International Conference on Future Computer and Communication (ICFCC). - Wuhan, 21-24 May 2010. - Vol. 3. - P. V3-581-V3-585-581. ↑
- C144.** Jeschke S. Crystalline Ge1-xSnx Heterostructures in Lateral High-Speed Devices. / Jeschke S., Pfeiffer O., Schulze J., Wilke M. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 53-58. ↑
- C145.** Osten H.J. Si Nanostructures Embedded into Crystalline Rare Earth Oxide Matrix for Opto and Nano Electronic Devices. / Osten H.J., Laha A., Fissel A. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 38-42. ↑
- C146.** Hasebe Y. Quantum Star Graphs and Spectral Branching Filter. / Hasebe Y., Cheon T. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 65-70. ↑
- C147.** Levesque T. Dip Pen Nanolithography® (DPN®) and the Deposition of Multiple Materials in Nanopatterning. / Levesque T., Jae-Won Jang, Smetana A., Stiles P. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 48-52. ↑
- C148.** Weddemann A. Magnetoresistive Detection of Magnetic Beads and Nanoparticles: Spatial Resolution and Number Sensitive Detection. / Weddemann A., Auge A., Albon C., Wittbracht F., Hutten A. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 33-37. ↑
- C149.** Gaikwad R. Atomic Force Microscopy Helps to Develop Methods for Physical Detection of Cancerous Cells. / Gaikwad R., Iyer S., Guz N., Volkov D., Dokukin M., Sokolov I., Woodworth C.D. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 18-22. ↑
- C150.** Williams R.L. Optoelectronic Devices Based on the Directed Self-Assembly of Single InAs/InP Quantum Dots. / Williams R.L., Dalacu D., Reimer M.E., Mnaymneh K., Poole P.J., Aers G.C., Lapointe J. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 43-47. ↑
- C151.** Ovchinnikov V. Fabrication of Thick Insulating Membrane Embedded in Si Substrate. / Ovchinnikov V., Liu Y. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 27-32. ↑
- C152.** Shunliu Zhao. Combination of Boundary Singularity and Direct Simulation Monte Carlo Methods for Nano-scale Flows. / Shunliu Zhao, Povitsky A. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 96-101. ↑
- C153.** Nakanishi M. On the Weakness of One-Way Quantum Pushdown Automata. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 83-87. ↑



- C154.** Azarbadegan A. Investigation of Double-Chamber Series Valveless Micropump: An Analytical Approach. / Azarbadegan A., Moeendarbary E., Cortes-Quiroz C.A., Eames I. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 107-112. ↑
- C155.** Johnston N. Schmidt Operator Norms and Entanglement Theory. / Johnston N., Kribs D.W. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 92-95. ↑
- C156.** Wen-Ran Zhang. YinYang Bipolar Quantum Entanglement-Toward a Logically Complete Quantum Theory. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 77-82. ↑
- C157.** Savio A. Study of the Wigner Function Computed by Solving the Schrödinger Equation. / Savio A., Poncet A. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 59-64. ↑
- C158.** Upton J.T. The Hidden Subgroup Problem for Generalized Quaternions. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 88-91. ↑
- C159.** Brida G. Experimental Sub-shot Noise Quantum Imaging versus Differential Classical Imaging. / Brida G., Genovese M., Monticone E., Portesi C., Rajteri M., Ruo-Berchera I. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 71-76. ↑
- C160.** Thakral G. P3 (power-performance-process) optimization of nano-CMOS SRAM using statistical DOE-ILP. / Thakral G., Mohanty S.P., Ghai D., Pradhan D.K. // 2010 11th International Symposium on Quality Electronic Design (ISQED). - San Jose, CA, 22-24 March 2010. - P. 176-183. ↑
- C161.** Ezzat H. Level matrix propagation for reliability analysis of nano-scale circuits based on probabilistic transfer matrix. / Ezzat H., Naviner L. // 2010 11th International Symposium on Quality Electronic Design (ISQED). - San Jose, CA, 22-24 March 2010. - P. 524-527. ↑
- C162.** Mann R.W. Limits of bias based assist methods in nano-scale 6T SRAM. / Mann R.W., Nalam S., Jiajing Wang, Calhoun B.H. // 2010 11th International Symposium on Quality Electronic Design (ISQED). - San Jose, CA, 22-24 March 2010. - P. 1-8. ↑
- C163.** Azam T. Variability resilient low-power 7T-SRAM design for nano-scaled technologies. / Azam T., Cheng B., Cumming D.R.S. // 2010 11th International Symposium on Quality Electronic Design (ISQED). - San Jose, CA, 22-24 March 2010. - P. 9-14. ↑
- C164.** Mirza-Aghatabar M. Algorithms to maximize yield and enhance yield/area of pipeline circuitry by insertion of switches and redundant modules. / Mirza-Aghatabar M., Breuer M.A., Gupta S.K. // 2010 Design, Automation & Test in Europe Conference & Exhibition (DATE). - Dresden, 8-12 March 2010. - P. 1249-1254. ↑
- C165.** Antoniadis D. Nanoelectronics challenges for the 21st century. 2010 Design, Automation & Test in Europe Conference & Exhibition (DATE). - Dresden, 8-12 March 2010. - P. 1487. ↑
- C166.** Bidabadi M. A novel analytical model of a MEMS vaporizing liquid micro thruster. / Bidabadi M., Heidari M.A., Rahbari A. // 2010 The 2nd International Conference on Computer and Automation Engineering (ICCAE). - Singapore, 26-28 Feb. 2010. - Vol. 5. - P. 321-325. ↑
- C167.** Sung-Seek Park. Multi-walled carbon nano tubes effects for methane hydrate formation. / Sung-Seek Park, Nam-Jin Kim. // 2010 The 2nd International Conference on Computer and Automation Engineering (ICCAE). - Singapore, 26-28 Feb. 2010. - Vol. 5. - P. 294-297. ↑
- C168.** Martel S. Aggregates of Synthetic Microscale Nanorobots versus Swarms of Computer-Controlled Flagellated Bacterial Robots for Target Therapies through the Human Vascular Network. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 14-17. ↑
- C169.** Katz E. Towards Biosensing Strategies Based on Biochemical Logic Systems. / Katz E., Privman V., Wang J. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 11-14. ↑



Maarten, 10-16 Feb. 2010. - P. 1-9. ↑

**C170.** Hiyama S. Selective Capture and Transport of Lipid Vesicles by Using DNAs and Biomolecular Motors. / Hiyama S., Moritani Y., Takeuchi S., Sutoh K. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 23-26. ↑

**C171.** Saeb M.R. Improving Thermo-mechanical Properties of Styrene Butadiene Rubber Nanocomposites Using Eggshell Bio-filler. / Saeb M.R., Ramezani-Dakheel H., Sarami R. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 10-13. ↑

**C172.** Vogel V. Shrunk to nano: The secret language of mechanical communication. 2010 IEEE 23rd International Conference on Micro Electro Mechanical Systems (MEMS). - Wanchai, Hong Kong, 24-28 Jan. 2010. - P. 83-87. ↑

**C173.** Zongliang Cao. Single-material MEMS using polycrystalline diamond. / Zongliang Cao, Varney M., Aslam D. // 2010 IEEE 23rd International Conference on Micro Electro Mechanical Systems (MEMS). - Wanchai, Hong Kong, 24-28 Jan. 2010. - P. 51-54. ↑

**C174.** Haifeng Yang. Smart drug delivery using electrospun hollow nanofibers. / Haifeng Yang, Liang Dong. // 2010 IEEE 23rd International Conference on Micro Electro Mechanical Systems (MEMS). - Wanchai, Hong Kong, 24-28 Jan. 2010. - P. 308-311. ↑

**C175.** Chen B.K. From microgripping to nanogripping. / Chen B.K., Zhang Y., Perovic D.D., Yu Sun. // 2010 IEEE 23rd International Conference on Micro Electro Mechanical Systems (MEMS). - Wanchai, Hong Kong, 24-28 Jan. 2010. - P. 296-299. ↑

**C176.** Wittbracht F. Flow Guidance of Magnetic Particles by Dipolar Particle Interaction. / Wittbracht F., Weddemann A., Auge A., Hutten A. // 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - St. Maarten, 10-16 Feb. 2010. - P. 102-106. ↑

**C177.** Lee M.H. Analysis and modeling of nano-crystalline silicon TFTs on flexible substrate with mechanical strain. / Lee M.H., Chang S.T., Huang J.-J., Hu G.-R., Huang Y.-S., Lee C.-C. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 654-655. ↑

**C178.** Hui Xu. A luminescent nano-scale metal-organic framework for sensing small molecules. / Hui Xu, Zhongshang Dou, Yuanjin Cui, Banglin Chen, Guodong Qian. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 308-309. ↑

**C179.** Jin Wang. Mesoporous activated carbon from amphiphilic carbonaceous material and its application in EDLC. / Jin Wang, Mingming Chen, Chengyang Wang, Jiaming Zheng. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 222-223. ↑

**C180.** Jiman Kim. Fully integrated circuit design Aihara's chaotic neuron model. / Jiman Kim, Jinwoo Jung, Bomin Kwon, Juhong Park, Namtae Kim, Yongsu Park, Jewon Lee, Hanjung Song. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 258-259. ↑

**C181.** Yu Zou. Behaviors of the different dispersers on the morphology of the porous TiO<sub>2</sub> films. / Yu Zou, Ding Ren, JiFu Du, HaiYang Dai, ChangYong Zhan, NingKang Huang. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 476-477. ↑

**C182.** Tae Il Lee. General route of nanowire field effect transistor. / Tae Il Lee, Won Jin Choi, Kyung-Ju Moon, Joohee Jeon, Hong Koo Baik, Jae-Min Myoung. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 1146-1148. ↑

**C183.** Anping Xu. Solid freeform fabrication of functionalized ceramic dental crown via selective slurry extrusion process. / Anping Xu, Dongbin Zhu, Yunxia Qu, Yushan Liu. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 381-382. ↑

**C184.** Juan Jiang. Electrical properties of Pb(Mg<sup>1/3</sup> Nb<sup>2/3</sup>)O<sub>3</sub>-PbTiO<sub>3</sub> (PMN-PT) epitaxial films grown on Si substrates. / Juan Jiang, Nak-Jin Seong, Hyun-Hee Hwang, Won-Jae Lee, Soon-Gil Yoon. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 456-457. ↑



- C185.** Yingzhan Yan. Integrated micro-and nano optical cavities on a chip for supersensitive sensing. / Yingzhan Yan, Zhe Ji, Shubin Yan, Jijun Xiong, Wendong Zhang. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 783-784. ↑
- C186.** Zhong Lin Wang. Top emerging technologies for self-powered nanosystems: nanogenerators and nanopiezotronics. 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 63-64. ↑
- C187.** Morvan R. Technological bricks and concepts for THz remote sensing. / Morvan R., Pillet G., Guiset P., Schnell J.P., Legagneux P., Megtert S., de Rossi A., Dolfi D., Torres J., Nouvel P., Marinchio H., Varani L., Chusseau L., Lampin J.-F., Bollaert S., Roelens Y. // 2010 IEEE Photonics Society Winter Topicals Meeting Series (WTM). - Majorca, 11-13 Jan. 2010. - P. 1-2. ↑
- C188.** Yi-Chia Chou. Nucleation and growth of epitaxial silicide in nanowire of silicon. / Yi-Chia Chou, Kuo-Chang Lu, Tu K.N. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 26-27. ↑
- C189.** Meitang Liu. Theoretical analyzing of monomers adsorbing in nano-slits. / Meitang Liu, Minfeng Pu, Hongwen Ma, Bozhong Mu. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 156-157. ↑
- C190.** Guangcun Shan. A model for THz silicon nanotube transistor. / Guangcun Shan, Miao Zhang, Wei Huang. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 181-182. ↑
- C191.** Bo Liu. Improvement of thermal stability of Cu/Cu(Zr)/p-SiOC:H film stack using an ultra-thin Zr(Ge) alloy film as an exhaustion interlayer. / Bo Liu, Jijun Yang, Yuan Wang, Kewei Xu. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 740-741. ↑
- C192.** Tailun Wong. Fabrication and structure characterization of Te butterfly nanostructures. / Tailun Wong, Guangwei She, Chun Cheng, Wei Li, Wensheng Shi, Xiaohong Zhang, Ning Wang. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 107-108. ↑
- C193.** {no data available}. Copyright Page. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - Netherlands Antilles, 10-16 Feb. 2010. - P. iv. ↑
- C194.** {no data available}. Preface. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - Netherlands Antilles, 10-16 Feb. 2010. - P. viii. ↑
- C195.** Sodhi A. Teaching non-linear dynamics through educational kits: Demo of memristor circuit kit. / Sodhi A., Gandhi G. // 2010 12th International Workshop on Cellular Nanoscale Networks and Their Applications (CNNA). - Berkeley, CA, 3-5 Feb. 2010. - P. 1. ↑
- C196.** {no data available}. Reviewers. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - Netherlands Antilles, 10-16 Feb. 2010. - P. xii-xiv. ↑
- C197.** {no data available}. Author Index. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - Netherlands Antilles, 10-16 Feb. 2010. - P. 113. ↑
- C198.** {no data available}. Publisher's Information. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - Netherlands Antilles, 10-16 Feb. 2010. - P. 114. ↑
- C199.** {no data available}. Title Page i. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - Netherlands Antilles, 10-16 Feb. 2010. - P. i. ↑
- C200.** {no data available}. Title Page iii. 2010. ICQNM '10. Fourth International Conference on Quantum, Nano and Micro Technologies. - Netherlands Antilles, 10-16 Feb. 2010. - P. iii. ↑
- C201.** Zhenkui Shen. Influence of nano-embossing on properties of Pb(Zr<sub>0.3</sub>,Ti<sub>0.7</sub>)O<sub>3</sub> ferroelectric thin film. / Zhenkui Shen, Zhihui Chen, Jiangrong Fang, Bingrui Lu, Zhijun Qiu, Anquan Jiang, Yifang Chen, Xiping Qu, Ran Liu. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 978-979. ↑



- C202.** Cheng C. Carbon-assisted growth technology for ZnO nanowires. / Cheng C., Wong T.L., Li W., Yu D.P., Wang N. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 929-930. ↑
- C203.** Chengdong Xu. The study of mechanical characteristic of electrodeposited nanocrystalline Ni-Co alloy. / Chengdong Xu, Yunhua Xu, Xiaojing Gong. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 1072-1073. ↑
- C204.** Zheng Jiang. Preparation of mesoporous N-doped TiO<sub>2</sub> via solvent evaporation induced assembly. / Zheng Jiang, Nianjun Luo, Jones M.O., Tiancun Xiao, Edwards P.P. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 1007. ↑
- C205.** Xue-song Ye. In situ Atomic Force Microscope observation of self-assembly adsorption of Bovine Serum Albumin on silica and gold nano film. / Xue-song Ye, Tao Zhou, Feng Liu, Jun Liu, Jian Sha, Ling Xia. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 860-861. ↑
- C206.** Ho Chang. Hybridization of ODNs with core-shell structure of Fe<sub>3</sub>O<sub>4</sub> nanoparticles and CSALG composite structure. / Ho Chang, LinWei Lin. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 854-855. ↑
- C207.** Xiao-Lin Wei. Molecular dynamics simulation of Argon-atom bombardment on graphene sheets. / Xiao-Lin Wei, Kai-Wang Zhang, Ru-Zhi Wang, Wen-Liang Liu, Jian-Xin Zhong. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 566-567. ↑
- C208.** Zengliang Yu. Controlling environmental pollution by application of inartificial nano material. / Zengliang Yu, Dongqing Cai, Jiang Jiang, Yuejin Wu, Xiangqin Wang, Dan Liu, Xu Wang, Hong Zhang, Yi Tang. // 2010 3rd International Nanoelectronics Conference (INEC). - Hong Kong, 3-8 Jan. 2010. - P. 878-879. ↑
- C209.** Lombaert H. Spatio-temporal segmentation of the heart in 4D MRI images using graph cuts with motion cues. / Lombaert H., Cheriet F. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 492-495. ↑
- C210.** van der Steen A.F.W. Intravascular ultrasound: Assessment of atherosclerosis. / van der Steen A.F.W., van Soest G., Emmer M., Maresca D., Jansen K., Mastik F., Serruys P.W., Regar E. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 281. ↑
- C211.** Ju Han. Chemical profiling of the plant cellwall through Raman microspectroscopy. / Ju Han, Singh S., Lan Sun, Simmons B., Auer M., Parvin B. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 1273-1276. ↑
- C212.** Bas E. Piecewise linear cylinder models for 3-dimensional axon segmentation in Brainbow imagery. / Bas E., Erdogmus D. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 1297-1300. ↑
- C213.** El-Baz A. Appearance analysis for diagnosing malignant lung nodules. / El-Baz A., Gimel'farb G., Falk R., El-Ghar M. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 193-196. ↑
- C214.** Raleva K. Electro-thermal modeling of nano-scale devices. / Raleva K., Vasilevska D., Goodnick S.M. // 2010 27th International Conference on Microelectronics Proceedings (MIEL). - Nis, 16-19 May 2010. - P. 395-398. ↑
- C215.** Karssemeijer N. Computer aided detection in breast imaging: More than perception aid. 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 273. ↑
- C216.** Deprez J.-F. Twin target correction for ultra-wideband radar imaging of breast tumours. / Deprez J.-F., Klemm M., Smith P.P., Craddock I. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 213-216. ↑
- C217.** Yendiki A. Challenges in MR image acquisition and analysis for probing the human connectome in vivo. 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 213-216. ↑



2010. - P. 633-634.

**C218.** Bo Zhao. Low rank matrix recovery for real-time cardiac MRI. / Bo Zhao, Haldar J.P., Brinegar C., Zhi-Pei Liang. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 996-999. ↑

**C219.** Tao Yu. Investigation on the effective immunity to process induced line-edge roughness in silicon nanowire MOSFETs. / Tao Yu, Wei Ding, Jing Zhuge, Liangliang Zhang, Runsheng Wang, Ru Huang. // 2010 International Symposium on VLSI Technology Systems and Applications (VLSI-TSA). - Hsinchu, 26-28 April 2010. - P. 32-33. ↑

**C220.** Chen-Ming Lee. A 30 nm gate-all-around poly-Si nano wire thin-film transistor. / Chen-Ming Lee, Bing-Yue Tsui. // 2010 International Symposium on VLSI Technology Systems and Applications (VLSI-TSA). - Hsinchu, 26-28 April 2010. - P. 28-29. ↑

**C221.** Xiahai Zhuang. Registration-based propagation for whole heart segmentation from compounded 3D echocardiography. / Xiahai Zhuang, Cheng Yao, YingLiang Ma, Hawkes D., Penney G., Ourselin S. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 1093-1096. ↑

**C222.** Se Young Chun. Sufficient condition for local invertibility of spatio-temporal 4D B-spline deformations. / Se Young Chun, Schretter C., Fessler J.A. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 1221-1224. ↑

**C223.** Themelis G. Advancing the technology and applications of surgical fluorescence imaging with targeted fluorochromes. / Themelis G., Sarantopoulos A., Harlaar N.J., van Dam G.M., Ntziachristos V. // 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 1010-1012. ↑

**C224.** Irwan R. Whole body imaging with dynamic volume 320-row CT. 2010 IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Rotterdam, 14-17 April 2010. - P. 1067-1068. ↑

**C225.** Sugimoto T. 12-Channel 4 20-Gbps on-board parallel optical modules using multi-chip visual alignment technique. / Sugimoto T., Hashimoto Y., Yamamoto K., Kurihara M., Oda M., Sakai J., Ono H., Akagawa T., Yashiki K., Hatayama H., Suzuki N., Tsuji M., Ogura I., Kouta H., Kurata K. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 256-262. ↑

**C226.** Amagai Masazumi. A study of package warpage for package on package (PoP). / Amagai Masazumi, Suzuki Yutaka. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 226-233. ↑

**C227.** Lee Kiwon. High power and fine pitch assembly using solder Anisotropic Conductive Films (ACFs) combined with ultrasonic bonding technique. / Lee Kiwon, Paik Kyung Wook. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 421-426. ↑

**C228.** Kondou Ryuichi. Room-temperature Si-SiN wafer bonding by nano-adhesion layer method. / Kondou Ryuichi, Wang Chenxi, Suga Tadamoto. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 357-362. ↑

**C229.** Mujller F. Nano-World: A showcase suite for technology-enhanced learning. / Mujller F., Guggisberg M., Burkhart H., Gyalog T. // 2010 IEEE Education Engineering (EDUCON). - Madrid, 14-16 April 2010. - P. 1075-1080. ↑

**C230.** Jiyoung Chang. MEMS packaging technologies & applications. / Jiyoung Chang, Liwei Lin. // 2010 International Symposium on VLSI Design Automation and Test (VLSI-DAT). - Hsin Chu, 26-29 April 2010. - P. 126-129. ↑

**C231.** Zheng Xie. Computation reduction for statistical analysis of the effect of nano-CMOS variability on asynchronous circuits. / Zheng Xie, Edwards D. // 2010 IEEE 13th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS). - Vienna, 14-16 April 2010. - P. 161-166. ↑

**C232.** Azarpeyvand A. Instruction reliability analysis for embedded processors. / Azarpeyvand A., Salehi M.E.,



Firouzi F., Yazdanbakhsh A., Fakhraie S.M. // 2010 IEEE 13th International Symposium on Design and Diagnostics of Electronic Circuits and Systems (DDECS). - Vienna, 14-16 April 2010. - P. 20-23. ↑

C233. John Ranjith Samuel E. Nano-integrated adhesive for cryogenic packaging (4K) of harsh environment electronics. / John Ranjith Samuel E., Malshe Ajay P., Dotsenko Vladimir, Delmas Jean, Webber Robert, Gupta Deepnarayan. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 960-966. ↑

C234. Kim Seung-Ho. High speed touch screen panels (TSPs) assembly using anisotropic conductive adhesives (ACAs) vertical ultrasonic bonding method. / Kim Seung-Ho, Lee Kiwon, Paik Kyung-Wook. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 1964-1967. ↑

C235. Han Y. D. Effect of Ni-coated carbon nanotubes on the microstructure and properties of a Sn-Ag-Cu solder. / Han Y. D., Tan C. M., Nai S. M. L., Xu L. Y., Jing H. Y., Wei J. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 979-984. ↑

C236. Orecchini G. Inkjet printed organic transistors for sustainable electronics. / Orecchini G., Zhang R., Agar J., Staiculescu D., Tentzeris M. M., Roselli L., Wong C. P. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 985-989. ↑

C237. Nakano Hiroshi. Advanced trench filling process by selective copper electrodeposition for ultra fine printed wiring board fabrication. / Nakano Hiroshi, Suzuki Hitoshi, Haba Toshio, Yoshida Hiroshi, Chinda Akira, Akahoshi Haruo. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 612-616. ↑

C238. Qin Yi. Near-eutectic Sn-Ag-Cu solder bumps formation for flip-chip interconnection by electrodeposition. / Qin Yi, Liu Changqing, Wilcox G.D., Zhao Kun, Wang Changhai. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 144-150. ↑

C239. Shin Ho Sun. Lattice deformation of Sn nanowires for the application to nano-interconnection technology. / Shin Ho Sun, Song Jae Yong, Yu Jin. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 1861-1865. ↑

C240. Sun Yangyang. Adhesion improvement for polymer dielectric to electrolytic-plated copper. / Sun Yangyang, Li Xiao, Gandhi Jaspreet, Luo Shijian, Jiang Tom. // 2010 Proceedings 60th Electronic Components and Technology Conference (ECTC). - Las Vegas, NV, USA, 1-4 June 2010. - P. 1106-1111. ↑

C241. Chih-Hong Hwang. Modeling of work-function fluctuation for 16 nm FinFET devices with TiN/HfSiON gate stack. / Chih-Hong Hwang, Yiming Li. // 2010 International Symposium on VLSI Technology Systems and Applications (VLSI-TSA). - Hsinchu, 26-28 April 2010. - P. 74-75. ↑

C242. Wao N. DNA Nano array analysis using hierarchical quality threshold clustering. / Wao N., Kashyap R., Jaiswal A. // 2010 The 2nd IEEE International Conference on Information Management and Engineering (ICIME). - Chengdu, 16-18 April 2010. - P. 81-85. ↑

C243. Pirich R. Effects of the lunar environment on space vehicle surfaces. / Pirich R., Weir J., Leyble D., Chu S., DiGiuseppe M. // 2010 Long Island Systems Applications and Technology Conference (LISAT). - Farmingdale, NY, 7-7 May 2010. - P. 1-6. ↑

C244. Pepe D. 60-GHz transceivers for wireless HD uncompressed video communication in nano-era CMOS technology. / Pepe D., Zito D. // MELECON 2010-2010 15th IEEE Mediterranean Electrotechnical Conference. - Valletta, 26-28 April 2010. - P. 1237-1240. ↑

C245. Chia-Sung Chiu. Power improvement for 65nm nMOSFET with high-tensile CESL and fast nonlinear behavior modeling. / Chia-Sung Chiu, Kun-Ming Chen, Guo-Wei Huang, Shu-Yu Lin, Bo-Yuan Chen, Cheng-Chou Hung, Sheng-Yi Huang, Cheng-Wen Fan, Chih-Yuh Tzeng, Sam Chou. // 2010 IEEE Radio Frequency Integrated Circuits Symposium (RFIC). - Anaheim, CA, 23-25 May 2010. - P. 589-592. ↑

C246. De Vivo B. Reliable bounds for the propagation delay in VLSI nano interconnects based on Multi Wall Carbon Nano Tubes. / De Vivo B., Lamberti P., Spinelli G., Tucci V. // 2010 IEEE 14th Workshop on Signal



Propagation on Interconnects (SPI). - Hildesheim, 9-12 May 2010. - P. 149-152. ↑

C247. Liwei Li. Applications of MEMS actuators in micro/nano robotic manipulators. 2010 2nd International Conference on Computer Engineering and Technology (ICCET). - Chengdu, 16-18 April 2010. - Vol. 2. - P. V2-649-V2-652-649. ↑

C248. Singh H. Analysis of SRAM Reliability under Combined Effect of NBTI, Process and Temperature Variations in Nano-Scale CMOS. / Singh H., Mahmoodi H. // 2010 5th International Conference on Future Information Technology (FutureTech). - Busan, 21-23 May 2010. - P. 1-4. ↑

C249. Yazdanbakhsh A. Architecture-Aware Graph-Covering Algorithm for Custom Instruction Selection. / Yazdanbakhsh A., Salehi M.E., Fakhraie S.M. // 2010 5th International Conference on Future Information Technology (FutureTech). - Busan, 21-23 May 2010. - P. 1-6. ↑

C250. Wunderle B. Thermal performance enhancement by exploitation of nano-effects. 2010 11th International Conference on Thermal, Mechanical & Multi-Physics Simulation, and Experiments in Microelectronics and Microsystems (EuroSimE). - Bordeaux, 26-28 April 2010. - P. 1. ↑

C251. Naumann F. Numerical investigations of the strain behavior in nanoscale patterned strained silicon structures. / Naumann F., Moutanabbir O., Reiche M., Schriever C., Schilling J., Petzold M. // 2010 11th International Conference on Thermal, Mechanical & Multi-Physics Simulation, and Experiments in Microelectronics and Microsystems (EuroSimE). - Bordeaux, 26-28 April 2010. - P. 1-5. ↑

C252. Hai Li. Compact model of memristors and its application in computing systems. / Hai Li, Miao Hu. // 2010 Design, Automation & Test in Europe Conference & Exhibition (DATE). - Dresden, 8-12 March 2010. - P. 673-678. ↑

C253. Pasca V. Error resilience of intra-die and inter-die communication with 3D spidergon STNoC. / Pasca V., Anghel L., Rusu C., Locatelli R., Coppola M. // 2010 Design, Automation & Test in Europe Conference & Exhibition (DATE). - Dresden, 8-12 March 2010. - P. 275-278. ↑

C254. Li Y. Test structures for characterising the integration of EWOD and SAW technologies for microfluidics. / Li Y., Fu Y.Q., Flynn B.W., Parkes W., Liu Y., Brodie S., Terry J.G., Haworth L.I., Bunting A.S., Stevenson J.T.M., Smith S., Walton A.J. // 2010 IEEE International Conference on Microelectronic Test Structures (ICMTS). - Hiroshima, 22-25 March 2010. - P. 52-57. ↑

C255. Tunc C. On-the-fly variation tolerant mapping in crossbar nano-architectures. / Tunc C., Tahoori M.B. // 2010 28th VLSI Test Symposium (VTS). - Santa Cruz, CA, 19-22 April 2010. - P. 105-110. ↑

C256. Auersperg J. Crack and damage in low-k BEoL stacks under assembly and CPI aspects. / Auersperg J., Vogel D., Lehr M.U., Grillberger M., Michel B. // 2010 11th International Conference on Thermal, Mechanical & Multi-Physics Simulation, and Experiments in Microelectronics and Microsystems (EuroSimE). - Bordeaux, 26-28 April 2010. - P. 1-6. ↑

C257. Li M.-J. Nano-engineered optical fibers and applications. / Li M.-J., Tandon P., Bookbinder D., Nolan D., Bickham S., McDermott M., Desorcie R., Englebert J., Logunov S., Kozlov V., West J. // 2010 Conference on (OFC/NFOEC) Optical Fiber Communication (OFC), collocated National Fiber Optic Engineers Conference. - San Diego, CA, 21-25 March 2010. - P. 1-3. ↑

C258. Khan S. Trends and challenges of SRAM reliability in the nano-scale era. / Khan S., Hamdioui S. // 2010 5th International Conference on Design and Technology of Integrated Systems in Nanoscale Era (DTIS). - Hammamet, 23-25 March 2010. - P. 1-6. ↑

C259. Kinam Kim. Technology challenges for deep-nano semiconductor. 2010 IEEE International Memory Workshop (IMW). - Seoul, 16-19 May 2010. - P. 1-2. ↑

C260. Chabi D. Hight fault tolerance in neural crossbar. / Chabi D., Klein J.-O. // 2010 5th International Conference on Design and Technology of Integrated Systems in Nanoscale Era (DTIS). - Hammamet, 23-25 March 2010. - P. 1-6. ↑

C261. Brousse O. Neuro-inspired learning of low-level image processing tasks for implementation based on nano-devices. / Brousse O., Paindavoine M., Gamrat C. // 2010 5th International Conference on Design and



Technology of Integrated Systems in Nanoscale Era (DTIS). - Hammamet, 23-25 March 2010. - P. 1-4. ↑

C262. Jongwoo Park. Mature processability and manufacturability by characterizing VT and Vmin behaviors induced by NBTI and AHTOL test. / Jongwoo Park, Sungmok Ha, Sunme Lim, Jae-Yoon Yoo, Junkyun Park, Kidan Bae, Gunrae Kim, Min Kim, Yongshik Kim. // 2010 IEEE International Reliability Physics Symposium (IRPS). - Anaheim, CA, 2-6 May 2010. - P. 104-110. ↑

C263. Lee W.C. Nano-electronics of high k dielectrics on exotic semiconductors for science and technology beyond Si CMOS. / Lee W.C., Chang P., Lee Y.J., Huang M.L., Lin T.D., Chu L.K., Chang Y.C., Chiu H.C., Chang Y.H., Lin C.A., Chang W.H., Chu R.L., Chiang T.H., Wu Y.D., Kwo J., Hong M. // 2010 International Symposium on VLSI Technology Systems and Applications (VLSI-TSA). - Hsinchu, 26-28 April 2010. - P. 173-174. ↑

C264. {no data available}. Title page. 2010 IEEE International Memory Workshop (IMW). - Seoul, 16-19 May 2010. - P. 1. ↑

C265. Han-Byul Kang. Electromigration of NiSi poly gated electrical fuse and its resistance behaviors induced by high temperature. / Han-Byul Kang, Jongwoo Park, Gun-Rae Kim, Hyun-Woo Park, Woon-Hak Lee, Joo-Byoung Yoon. // 2010 IEEE International Reliability Physics Symposium (IRPS). - Anaheim, CA, 2-6 May 2010. - P. 265-270. ↑

C266. Zhen Liu. Nano Air Vehicle wing concepts design and experimental study of nano rotor hovering performance. / Zhen Liu, Min Xu. // 2010 2nd International Conference on Computer Engineering and Technology (ICCET). - Chengdu, 16-18 April 2010. - Vol. 5. - P. V5-205-V5-209-205. ↑

C267. Lei Jiao. Partner selection of virtual enterprise using two-layer ant colony optimization. / Lei Jiao, Zhonghua Ni, Xiaojun Liu, Tingyu Liu. // 2010 2nd International Conference on Computer Engineering and Technology (ICCET). - Chengdu, 16-18 April 2010. - Vol. 1. - P. V1-345-V1-349-345. ↑

C268. Xiaojun Liu. Development of CAPP based on 2.5D machining feature recognition. / Xiaojun Liu, Zhonghua Ni, Yalong Cheng, Tingyu Liu, Lei Jiao. // 2010 2nd International Conference on Computer Engineering and Technology (ICCET). - Chengdu, 16-18 April 2010. - Vol. 1. - P. V1-668-V1-672-668. ↑

C269. Tingyu Liu. The stem-based vector space model for automatic resource allocation in workflow. / Tingyu Liu, Zhonghua Ni, Lei Jiao, Xiaojun Liu. // 2010 2nd International Conference on Computer Engineering and Technology (ICCET). - Chengdu, 16-18 April 2010. - Vol. 1. - P. V1-631-V1-634-631. ↑

C270. Li Wen. Fabrication of a novel microcantilever probe with inverted pyramidal microdischarge for maskless scanning plasma etching. / Li Wen, Qiu-Ping Zhang, Wei-Wei Xiang, Hai Wang, Li-Wen He, Jia-Ru Chu. // 2010 Symposium on Design Test Integration and Packaging of MEMS/MOEMS (DTIP). - Seville, 5-7 May 2010. - P. 387-390. ↑

C271. Itoh T. Continuous nano/micro-machining and weaving integration process for fiber substrates. / Itoh T., Takamatsu S., Kobayashi T., Shibayama N., Miyake K. // 2010 Symposium on Design Test Integration and Packaging of MEMS/MOEMS (DTIP). - Seville, 5-7 May 2010. - P. 320-325. ↑

C272. Liu A.Q. Photonic micromachined tunable lasers. 2010 Symposium on Design Test Integration and Packaging of MEMS/MOEMS (DTIP). - Seville, 5-7 May 2010. - P. 111-113. ↑

C273. Kolew A. Replication of micro and sub-micro structures by means of hot embossed polymer inserts. / Kolew A., Sikora K., Munch D., Worgull M. // 2010 Symposium on Design Test Integration and Packaging of MEMS/MOEMS (DTIP). - Seville, 5-7 May 2010. - P. 339-343. ↑

C274. Kun Qian. Modeling and thermal analysis of silicon infrared emitter based on SOI wafer. / Kun Qian, Fangqiang Li, Haisheng San, Xuyuan Chen. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 114-117. ↑

C275. Zheng Fan. Spheres on pillars: Nanobubbling based on attogram mass delivery from metal-filled nanotubes. / Zheng Fan, Xinyong Tao, Xudong Cui, Xudong Fan, Lixin Dong. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 649-654. ↑

C276. Bhavsar S.N. Effect of redeposition-An important consideration in existing mathematical model of



sputtering process in focused ion beam milling. / Bhavsar S.N., Aravindan S., Venkateswara Rao P. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 768-770. ↑

C277. Hyunmin Kang. TiO<sub>2</sub> nanoparticle generation by flame pyrolysis FFESS system. / Hyunmin Kang, Heil P.E., Hyungsoo Choi, Kyekyoon Kim. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 493-496. ↑

C278. Yu Zhang. Cutting graphene using an atomic force microscope based nanorobot. / Yu Zhang, Lianqing Liu, Ning Xi, Yuechao Wang, Zaili Dong. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 639-644. ↑

C279. Chia-Jung Chang. Control the movement of a single dsDNA by DEP. / Chia-Jung Chang, Pen-Cheng Wang, Fan-Gang Tseng. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 1040-1044. ↑

C280. Haron N.Z. Mitigating defective CMOS to Non-CMOS vias in CMOS/Molecular memories. / Haron N.Z., Hamdioui S. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 1096-1099. ↑

C281. Yajing Shen. Cell-cell adhesion force measurement using nano picker via nanorobotic manipulators inside ESEM. / Yajing Shen, Ahmad M.R., Nakajima M., Kojima S., Homma M., Fukuda T. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 870-874. ↑

C282. SangWook Lee. Biomarker capturing platform using LC-ESI/MS/MS coupled aptamer microarray. / SangWook Lee, Ji-Young Ahn, Soyoun Kim, Laurell T. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 991-994. ↑

C283. Ahmad M.R. Nanofork and Line-patterned Substrate for measuring single cells adhesion force inside ESEM. / Ahmad M.R., Nakajima M., Kojima M., Kojima S., Homma M., Fukuda T. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 356-359. ↑

C284. Nachtigal M. Design of a reversible single precision floating point multiplier based on operand decomposition. / Nachtigal M., Thapliyal H., Ranganathan N. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 233-237. ↑

C285. Kyung-Sang Cho. Band-level control for high-performance colloidal quantum-dot LED. / Kyung-Sang Cho, Byoung Lyong Choi, Eun Kyung Lee, Tae-Ho Kim, Sang Jin Lee, Jong Min Kim. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 275-280. ↑

C286. Hanninen I. Irreversible bit erasures in binary adders. / Hanninen I., Takala J. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 223-226. ↑

C287. Nikodem M. Logic circuit synthesis using Threshold Gates based on nanodevices with negative differential resistance property. / Nikodem M., Bawiec M.A. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 227-232. ↑

C288. Hornung M. 6 inch full field wafer size nanoimprint lithography for photonic crystals patterning. / Hornung M., Ran Ji, Verschuuren M., van den Laar R. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 339-342. ↑

C289. Zhan Yang. Nanoassembly of pH sensor nanoprobe by mutiple-metallic nanowires. / Zhan Yang, Nakajima M., Ode Y., Fukuda T. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 352-355. ↑

C290. Jing Hou. Modeling and analyzing nano-rod pushing with an AFM. / Jing Hou, Chengdong Wu, Lianqing Liu, Zhidong Wang, Zaili Dong. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 329-334. ↑

C291. Sang-Kon Kim. Process simulation of block copolymer lithography. 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 335-338. ↑

C292. Roco M.C. Nanotechnology progress and future opportunities: 2000-2020. 2010 10th IEEE Conference



on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 11-12. ↑

C293. Dunham S.T. Multiscale modeling of nanoscale device fabrication. 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 85-89. ↑

C294. Johan Liu. Use of Carbon nanotubes in potential electronics packaging applications. / Johan Liu, Teng Wang, Yifeng Fu, Lilei Ye. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 160-166. ↑

C295. Kinam Kim. From the future technology perspective: challenges and opportunities. 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 4-5. ↑

C296. Leitenstorfer A. FemtoTera quantum optics: single cycles of light, single electrons and photons. / Leitenstorfer A., Bratschitsch R., Huber R. // 2010 23rd Annual Meeting of the IEEE Photonics Society. - Denver, CO, 7-11 Nov. 2010. - P. 42-43. ↑

C297. Cunningham B.T. Biosensing with photonic crystal surfaces. 2010 23rd Annual Meeting of the IEEE Photonics Society. - Denver, CO, 7-11 Nov. 2010. - P. 158-159. ↑

C298. Rotkin S.V. Surface polariton scattering for charge transport and heat management in carbon-based heterogeneous electronics: Problem or solution?. / Rotkin S.V., Petrov A.G. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 66-71. ↑

C299. Fukuda T. Robotic manipulation and control for Micro and Nano mechatronics. / Fukuda T., Nakajima M., Ahmad M.R., Yajing Shen, Nogawa K., Kojima M. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 111-114. ↑

C300. Je-Kyun Park. Lab-on-a-Chip Technology for Integrative Bioengineering. 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 156-159. ↑

C301. Sangin Kim. Nanotechnology commercialization: World and Korean trends and their perspectives. / Sangin Kim, Jaejin Lee, Hanjo Lim, Dae-sup So, Kyung Ho Kim. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 1193-1196. ↑

C302. Sahoo S. Socio-ethical issues and nanotechnology development: Perspectives from India. 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 1205-1210. ↑

C303. Gwi-Nam Bae. Real-time monitoring of nanoparticles at a metal nanopowder manufacturing workplace. / Gwi-Nam Bae, Seung-Bok Lee, Dong-Chun Shin, Dong Jin Lee. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 1183-1186. ↑

C304. Jungil Lee. Code of conduct for nanotechnology researchers. / Jungil Lee, Sangin Kim, Jaejin Lee, Hanjo Lim. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 1189-1192. ↑

C305. Soo-Jung Son. Manufacturing of micro gas bearing for power MEMS applications using nanopowder metallurgy processing. / Soo-Jung Son, Chul-Jin Choi, Daejung Kim, Jong-Hyun Kim, Suk-Sang Chang. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 406-409. ↑

C306. Kangyol Lee. Development of technology to pulverize natural plant material into d97 3 µm size of powder using air classifier mill. / Kangyol Lee, Beomgoo Lee, Juho Sun, Wiesoo Kang. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 567-569. ↑

C307. Jongwook Kim. SiO<sub>2</sub>/Si<sub>3</sub>N<sub>4</sub> bilayer sloped etching for 20nm InAlAs/InGaAs metamorphic HEMTs. / Jongwook Kim, Minseong Lee, Kwangseok Seo. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 246-249. ↑

C308. Sulieman M.H. Low-power and highly reliable logic gates transistor-level optimizations. / Sulieman M.H., Beiu V., Ibrahim W. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 254-257. ↑

C309. Shiratani M. Keynote speech I: Fluctuation control for plasma nanotechnologies. / Shiratani M., Koga K.,



Uchida G., Itagaki N., Kamataki K. // TENCON 2010-2010 IEEE Region 10 Conference. - Fukuoka, 21-24 Nov. 2010. - P. xii-xvi. ↑

C310. Stukova E.V. Nonlinear dielectric properties of NaNO<sub>2</sub> in silicate matrices MCM-41. / Stukova E.V., Baryshnikov S.V., Charnaya E.V., Michel D., Cheng Tien. // 2010 IEEE 2nd Russia School and Seminar on Fundamental Problems of Micro/Nanosystems Technologies (MNST). - Novosibirsk, 9-11 Dec. 2010. - P. 14-16. ↑

C311. Kosakabe T. Heat spreader technology for silicon chip. / Kosakabe T., Mochizuki M., Mashiko K., Saito Y., Kiyooka F., Horiuchi Y., Cabusao G., Thang Nguyen. // 2010 IEEE CPMT Symposium Japan. - Tokyo, 24-26 Aug. 2010. - P. 1-4. ↑

C312. Piramanayagam S.N. Challenges of patterned media. 2010 Digest APMRC. - Singapore, Singapore, 10-12 Nov. 2010. - P. 1-2. ↑

C313. Matsumura Y. Control of self-organization microporous honeycomb film by the irradiation of nano second laser pulse: Deliberation of heat affected and shock wave by laser irradiation. / Matsumura Y., Inami W., Kawata Y. // 2010 International Symposium on Optomechatronic Technologies (ISOT). - Toronto, ON, 25-27 Oct. 2010. - P. 1-4. ↑

C314. Kobayashi M. Coordinate measurement of micro groove on MEMS device by optically controlled microprobe. / Kobayashi M., Michihata M., Hayashi T., Takaya Y. // 2010 International Symposium on Optomechatronic Technologies (ISOT). - Toronto, ON, 25-27 Oct. 2010. - P. 1-5. ↑

C315. Otani Y. Manipulation of droplet and crystal growth by Paul effect. / Otani Y., Mizutani Y., Yamabe Y. // 2010 International Symposium on Optomechatronic Technologies (ISOT). - Toronto, ON, 25-27 Oct. 2010. - P. 1-4. ↑

C316. Akhavan H. Nano-fabrication dependent quality factor in photonic crystal slab biosensors. / Akhavan H., El-Beheiry M., Levi O. // 2010 International Symposium on Optomechatronic Technologies (ISOT). - Toronto, ON, 25-27 Oct. 2010. - P. 1-4. ↑

C317. Fukuda T. Social impact of in-vitro endovascular surgery simulation technology. / Fukuda T., Tercero C.R., Ikeda S., Negoro M. // 2010 IEEE Workshop on Advanced Robotics and its Social Impacts (ARSO). - Seoul, 26-28 Oct. 2010. - P. 142-147. ↑

C318. Nakajima M. Nanoprobe insertion for nano-injection based on E-SEM nanorobotic manipulation. / Nakajima M., Hirano T., Kojima M., Hisamoto N., Homma M., Beom Hee Lee, Fukuda T. // 2010 International Symposium on Micro-NanoMechatronics and Human Science (MHS). - Nagoya, 7-10 Nov. 2010. - P. 491-496. ↑

C319. Zhan Yang. Fabrication and evaluation of nano probe pH sensor based on nanorobotic manipulation. / Zhan Yang, Nakajima M., Ode Y., Zhenhai Zhang, Fukuda T. // 2010 International Symposium on Micro-NanoMechatronics and Human Science (MHS). - Nagoya, 7-10 Nov. 2010. - P. 284-289. ↑

C320. Hsin-Chia Yang. Study of nano-regime strained MOSFETs with temperature effects. / Hsin-Chia Yang, Wen-Shiang Liao, Min-Ru Peng, Mu-Chun Wang, Zhen-Ying Hsieh, Shuang-Yuan Chen, Heng-Sheng Huang. // 2010 International Symposium on Next-Generation Electronics (ISNE). - Kaohsiung, 18-19 Nov. 2010. - P. 186-189. ↑

C321. Yajing Shen. Nano knife fabrication and calibration for single cell cutting inside environmental SEM. / Yajing Shen, Nakajima M., Kojima S., Homma M., Fukuda T. // 2010 International Symposium on Micro-NanoMechatronics and Human Science (MHS). - Nagoya, 7-10 Nov. 2010. - P. 316-320. ↑

C322. Lo P. Silicon integrated electronic-photonic ICs. / Lo P., Dim-Lee Kwong. // 2010 International Conference on Optical MEMS and Nanophotonics (OPT MEMS). - Sapporo, 9-12 Aug. 2010. - P. 53-54. ↑

C323. Vasileska D. Thermal modeling of nanodevices. / Vasileska D., Raleva K., Goodnick S.M., Aksamija Z., Knezevic I. // 2010 14th International Workshop on Computational Electronics (IWCE). - Pisa, 26-29 Oct. 2010. - P. 1-5. ↑

C324. Wild H. Positioning loads within the nanometer scale the mechatronic way to do it. 2010 International Symposium on Micro-NanoMechatronics and Human Science (MHS). - Nagoya, 7-10 Nov. 2010. - P. 1. ↑



- C325.** Hee-Shin Kang. Quality monitoring of laser welding. / Hee-Shin Kang, Jeong Suh, Tae-Hyun Kim, Taik-Dong Cho. // 2010 International Conference on Control Automation and Systems (ICCAS). - Gyeonggi-do, 27-30 Oct. 2010. - P. 2144-2147. ↑
- C326.** Eleftheriou E. Recent advances in high-throughput scanning-probe technology. 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 105-110. ↑
- C327.** Pellizzer F. Non-Volatile semiconductor memories for nano-scale technology. / Pellizzer F., Bez R. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 21-24. ↑
- C328.** Kapadia R. Nanowire-based 2-D and 3-D XoY electronics. / Kapadia R., Takei K., Takahashi T., Ruebusch D., Javey A. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 37-40. ↑
- C329.** Yablonovitch E. Metal optics, optical antennas, and spontaneous hyper-emission. 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 13-14. ↑
- C330.** Yongsik Jeong. Development of sub-100  $\mu$ W microwave RTD VCOs. / Yongsik Jeong, Sunkyu Choi, Kyoungsoon Yang. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 214-216. ↑
- C331.** Thapliyal H. Reversible logic based concurrent error detection methodology for emerging nanocircuits. / Thapliyal H., Ranganathan N. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 217-222. ↑
- C332.** Weiqiang Liu. Montgomery modular multiplier design in quantum-dot cellular automata using cut-set retiming. / Weiqiang Liu, Liang Lu, O'Neill M., Swartzlander E.E. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 205-210. ↑
- C333.** Jongwon Lee. Implementation of a 4  $\times$  1 multiplexing quantum-effect IC based on RTD circuit topology. / Jongwon Lee, Sunkyu Choi, Kyoungsoon Yang. // 2010 10th IEEE Conference on Nanotechnology (IEEE-NANO). - Seoul, 17-20 Aug. 2010. - P. 211-213. ↑
- C334.** Xuefeng Yan. A new saw device with tellurium sensing film for NO<sub>2</sub> detection. / Xuefeng Yan, Dongmei Li, Ming Liu, Tianchun Ye. // 2010 International Conference on Advanced Intelligence and Awareness Internet (AIAI 2010). - Beijing, China, 23-25 Oct. 2010. - P. 146-148. ↑
- C335.** Dey D. Integration of plasmonic antenna on quantum cascade laser facets for chip-scale molecular sensing. / Dey D., Kohoutek J., Gelfand R.M., Bonakdar A., Mohseni H. // 2010 IEEE Sensors. - Kona, HI, 1-4 Nov. 2010. - P. 454-458. ↑
- C336.** Takao H. A robust and sensitive silicon tactile imager with individually formed SU-8 protective layers on piezoresistor pixels. / Takao H., Okada H., Ishida M., Terao K., Suzuki T., Oohira F. // 2010 IEEE Sensors. - Kona, HI, 1-4 Nov. 2010. - P. 2079-2082. ↑
- C337.** Rostami A. Performance enhancement of organic solar cells using plasmonic effects. / Rostami A., Rasooli H., Andalibi S., Janabi-Sharifi F. // 2010 International Symposium on Optomechatronic Technologies (ISOT). - Toronto, ON, 25-27 Oct. 2010. - P. 1-6. ↑
- C338.** {no data available}. Copyrite. 2010 IEEE Sensors. - Kona, HI, 1-4 Nov. 2010. - P. 1. ↑
- C339.** Weigel-Jech M. Towards automated handling of biomaterials for nano-biosensor fabrication. / Weigel-Jech M., Niewiera F., Fatikow S. // 2010 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM). - Montreal, ON, 6-9 July 2010. - P. 842-847. ↑
- C340.** Shiraishi T. Positioning control for Piezo scanner using multirate perfect inverse model based iterative learning control. / Shiraishi T., Fujimoto H. // 2010 IEEE/ASME International Conference on Advanced Intelligent Mechatronics (AIM). - Montreal, ON, 6-9 July 2010. - P. 993-998. ↑
- C341.** Hopsch F. Variation-Aware Fault Modeling. / Hopsch F., Becker B., Hellebrand S., Polian I., Straube B., Vermeiren W., Wunderlich H.-J. // 2010 19th IEEE Asian Test Symposium (ATS). - Shanghai, 1-4 Dec. 2010. - P. 87-93. ↑



- C342.** Sirigir V.K. Ultra-low-Power Ultra-fast Hybrid CNEMS-CMOS FPGA. / Sirigir V.K., Alzoubi K., Saab D.G., Kocan F., Tabib-Azar M. // 2010 International Conference on Field Programmable Logic and Applications (FPL). - Milano, Aug. 31 2010-Sept. 2 2010. - P. 368-373. ↑
- C343.** Sridevi V. Unipolar characteristics of Carbon Nanotube Field Effect Transistor. / Sridevi V., Jayanthi T. // 2010 Recent Advances in Space Technology Services and Climate Change (RSTSCC). - Chennai, 13-15 Nov. 2010. - P. 223-228. ↑
- C344.** Varthamanan Y. Current voltage characteristics of Carbon Nano Tube Field Effect Transistor. / Varthamanan Y., Kannan V. // 2010 Recent Advances in Space Technology Services and Climate Change (RSTSCC). - Chennai, 13-15 Nov. 2010. - P. 283-284. ↑
- C345.** Sheela Rani B. Comparative study of different structures of nanosatellite and its analysis. / Sheela Rani B., Mahesh Babu T.S., Srinivasan M. // 2010 Recent Advances in Space Technology Services and Climate Change (RSTSCC). - Chennai, 13-15 Nov. 2010. - P. 317-320. ↑
- C346.** Rani B.S. On board communication subsystem for Sathyabama University nano-satellite. / Rani B.S., Logashanmugam E., Rajarajan S., Sugadev M., Jegan G., Kumar N.J., Kumar N.J. // 2010 Recent Advances in Space Technology Services and Climate Change (RSTSCC). - Chennai, 13-15 Nov. 2010. - P. 143-145. ↑
- C347.** Ying Shen. Detection of water pollution by sonoluminescence technology. / Ying Shen, Chunsheng Yan. // 2010 OSA-IEEE-COS Advances in Optoelectronics and Micro/Nano-Optics (AOM). - Guangzhou, 3-6 Dec. 2010. - P. 1-3. ↑
- C348.** Mozaffari S. Joint-PDF of timing and power of nano-scaled CMOS digital gates due to channel length variation. / Mozaffari S., Aghababa H., Afzali-Kusha A. // 2010 IEEE International Conference of Electron Devices and Solid-State Circuits (EDSSC). - Hong Kong, 15-17 Dec. 2010. - P. 1-4. ↑
- C349.** Sooriaselvam R. Micro air vehicle with nano-sensors to capture the enemy's arsenal. 2010 Recent Advances in Space Technology Services and Climate Change (RSTSCC). - Chennai, 13-15 Nov. 2010. - P. 400-404. ↑
- C350.** Sheela Rani B. Electronic power supply design for Sathyabama University Nano Satellite. / Sheela Rani B., Baig M., Vasanth K., Kannan V. // 2010 Recent Advances in Space Technology Services and Climate Change (RSTSCC). - Chennai, 13-15 Nov. 2010. - P. 470-472. ↑
- C351.** Pandit S. Effect of gate fringing and dopant redistribution on the width-dependence of threshold voltage of narrow channel shallow trench isolated MOSFETs. / Pandit S., Sarkar C.K. // 2010 Annual IEEE India Conference (INDICON). - Kolkata, 17-19 Dec. 2010. - P. 1-4. ↑
- C352.** Sugimoto Y. Nanophotonics technology for advanced quantum dot/photonic crystal device and metal/semiconductor plasmonic device. / Sugimoto Y., Ikeda N., Tsuya D., Ozaki N., Oda H., Yamanaka A., Miura A., Nomura T., Inoue D., Fujikawa H., Ohkouchi S., Watanabe Y., Koide Y., Satoh K., Asakawa K. // 2010 Photonics Global Conference (PGC). - Singapore, 14-16 Dec. 2010. - P. 1-5. ↑
- C353.** Venkatesan M. Nanorobots in cancer treatment. / Venkatesan M., Jolad B. // 2010 International Conference on Emerging Trends in Robotics and Communication Technologies (INTERACT). - Chennai, 3-5 Dec. 2010. - P. 258-264. ↑
- C354.** Nogami T. High reliability 32 nm Cu/ULK BEOL based on PVD CuMn seed, and its extendibility. / Nogami T., Bolom T., Simon A., Kim B., Hu C., Tsumura K., Madan A., Baumann F., Wang Y., Flaitz P., Parks C., DeHaven P., Davis R., Zaitz M., Lawrence B.S., Murphy R., Tai L., Molis S., Rhee S., Usui T., Cabral C., Maniscalco J., Clevenger L., Li B., Christiansen C., Chen F., Lee T., Schmatz J., Shobha H., Ito F., Ryan T., Nguyen S., Canaperi D., Arnold J., Choi S., Cohen S., Liniger E., Chen H., Chen S., Vo T., Kelly J., Straten O., Penny C., Bonilla G., Kozlowski P., Spooner T., Edelstein D. // 2010 IEEE International Electron Devices Meeting (IEDM). - San Francisco, CA, 6-8 Dec. 2010. - P. 33.5.1-33.5.4. ↑
- C355.** Min-Cheng Chen. A novel smart nanowire biosensor with hybrid sensor/memory/CMOS technology. / Min-Cheng Chen, Hou-Yu Chen, Chia-Yi Lin, Chuan-Mei Tsai, Chung-Fan Hsieh, Jim-Tong Horng, Jian-Tai Qiu, Chien-Chao Huang, Fu-Liang Yang. // 2010 IEEE International Electron Devices Meeting (IEDM). - San Francisco, CA, 6-8 Dec. 2010. - P. 36.2.1-36.2.4. ↑



- C356.** Pable S.D. Performance optimization of CNFET based subthreshold circuits. / Pable S.D., Imran A., Hasan M. // 2010 Annual IEEE India Conference (INDICON). - Kolkata, 17-19 Dec. 2010. - P. 1-4. ↑
- C357.** Sengupta S. Statistical study of the effect of process variations on nano-scale CMOS circuits with scaling. / Sengupta S., Pandit S. // 2010 Annual IEEE India Conference (INDICON). - Kolkata, 17-19 Dec. 2010. - P. 1-4. ↑
- C358.** Kalpat S. Requirement of effective fabless/foundry interactions for achieving robust product reliability. / Kalpat S., Mogul H., Hau-Riege C., Hnatek E.R., Liu J.H., You-Wen Yau. // 2010 IEEE International Integrated Reliability Workshop Final Report (IRW). - Stanford Sierra, CA, 17-21 Oct. 2010. - P. 22. ↑
- C359.** Tingting Wang. Intragrain compositional gradient barium strontium titanate ceramics fabricated by a sol-assisted sintering technology. / Tingting Wang, Dengren Jin, Jinrong Cheng, Juan Li. // 2010 IEEE International Symposium on the Applications of Ferroelectrics (ISAF). - Edinburgh, 9-12 Aug. 2010. - P. 1-4. ↑
- C360.** Penkin D. A study on communication aspects of two-dimensional large-scale wireless sensor networks using percolation principles. / Penkin D., Yarovoy A., Janssen G. // 2010 17th IEEE Symposium on Communications and Vehicular Technology in the Benelux (SCVT). - Enschede, 24-25 Nov. 2010. - P. 1-6. ↑
- C361.** Rahman M. Analyzing Carbon Nanotube interconnects in VLSI application. / Rahman M., Chowdhury A.A. // 2010 13th International Conference on Computer and Information Technology (ICCIT). - Dhaka, 23-25 Dec. 2010. - P. 237-240. ↑
- C362.** Khir M.H.M. Nonlinear controller and observer designs of a CMOS-MEMS nano-newton force sensor. / Khir M.H.M., Pornthanomwong T., Loh R.N.K., Hongwei Qu. // 2010 International Conference on Intelligent and Advanced Systems (ICIAS). - Manila, 15-17 June 2010. - P. 1-6. ↑
- C363.** Kushairi N. Characterization of wideband square spiral inductors based on 0.15  $\mu\text{m}$  GaAs pHEMT technology. / Kushairi N., Osman M.N., Rahim A.I.A., Dolah A., Rahayu Y. // 2010 IEEE Asia-Pacific Conference on Applied Electromagnetics (APACE). - Port Dickson, 9-11 Nov. 2010. - P. 1-4. ↑
- C364.** Schmitt Wolfgang. Novel silver contact paste lead free solution for die attach. / Schmitt Wolfgang, GmbH W. C. Heraeus. // 2010 6th International Conference on Integrated Power Electronics Systems (CIPS). - Nuremberg, Germany, 16-18 March 2010. - P. 1-6. ↑
- C365.** Akyildiz Ian F. Nanonetworks: A new frontier in communications. Proceedings of the 2010 International Conference on e-Business (ICE-B). - Athens, Greece, 26-28 July 2010. - P. IS-5-5. ↑
- C366.** Pierantoni L. Radio-frequency nanoelectronics: A new paradigm in electronic systems design. / Pierantoni L., Coccetti F. // 2010 Asia-Pacific Microwave Conference Proceedings (APMC). - Yokohama, 7-10 Dec. 2010. - P. 1007-1014. ↑
- C367.** Knoerr Matthias. Power semiconductor joining through sintering of silver nanoparticles: Evaluation of influence of parameters time, temperature and pressure on density, strength and reliability. / Knoerr Matthias, Schletz Andreas. // 2010 6th International Conference on Integrated Power Electronics Systems (CIPS). - Nuremberg, Germany, 16-18 March 2010. - P. 1-6. ↑
- C368.** Vasiliev M. The properties of nanocomposite  $(\text{BiDy})_3(\text{FeGa})_5\text{O}_{12}:\text{Bi}_2\text{O}_3$  magneto-optic garnet films for applications in nanophotonics, ultrafast switching and integrated optoelectronics. / Vasiliev M., Nur-E-Alam M., Kotov V., Alameh K. // 2010 High-Capacity Optical Networks and Enabling Technologies (HONET). - Cairo, 19-21 Dec. 2010. - P. 258-261. ↑
- C369.** Natarajan K. Rapid Emergence and Convergence of Electronic Technologies as Multiplying Factor for Innovation Capability. 2010 International Symposium on Electronic System Design (ISED). - Bhubaneswar, 20-22 Dec. 2010. - P. 3. ↑
- C370.** Banerjee S. A Taylor Expansion Diagram Approach for Nano-CMOS RTL Leakage Optimization. / Banerjee S., Mathew J., Pradhan D.K., Mohanty S.P., Ciesielski M. // 2010 International Symposium on Electronic System Design (ISED). - Bhubaneswar, 20-22 Dec. 2010. - P. 71-76. ↑
- C371.** Linfeng Du. RDF effect induced by source/drain doping in nano-scale UTB SOI MOSFET with nominally un-doped channel. / Linfeng Du, Shengdong Zhang. // 2010 IEEE International Conference of Electron Devices



and Solid-State Circuits (EDSSC). - Hong Kong, 15-17 Dec. 2010. - P. 1-4. ↑

**C372.** Zhitang Song. Phase change materials and random access memory. / Zhitang Song, Feng Rao, Yun Ling, Liangcai Wu, Bo Liu. // 2010 IEEE International Conference of Electron Devices and Solid-State Circuits (EDSSC). - Hong Kong, 15-17 Dec. 2010. - P. 1-4. ↑

**C373.** Das N. Impact of metal nano-grating phase-shift on plasmonic MSM photodetectors. / Das N., Karar A., Chee Leong Tan, Alameh K., Yong Tak Lee. // 2010 High-Capacity Optical Networks and Enabling Technologies (HONET). - Cairo, 19-21 Dec. 2010. - P. 96-100. ↑

**C374.** Karar A. Design of high-sensitivity plasmonics-assisted GaAs metal-semiconductor-metal photodetectors. / Karar A., Das N., Tan C.L., Alameh K., Yong Tak Lee. // 2010 High-Capacity Optical Networks and Enabling Technologies (HONET). - Cairo, 19-21 Dec. 2010. - P. 138-142. ↑

**C375.** Mahapatro M. Design of Arithmetic Circuits Using Reversible Logic Gates and Power Dissipation Calculation. / Mahapatro M., Panda S.K., Satpathy J., Saheel M., Suresh M., Panda A.K., Sukla M.K. // 2010 International Symposium on Electronic System Design (ISED). - Bhubaneswar, 20-22 Dec. 2010. - P. 85-90. ↑

**C376.** Garitselov O. Nano-CMOS Mixed-Signal Circuit Metamodeling Techniques: A Comparative Study. / Garitselov O., Mohanty S.P., Kougianos E., Patra P. // 2010 International Symposium on Electronic System Design (ISED). - Bhubaneswar, 20-22 Dec. 2010. - P. 191-196. ↑

**C377.** Syamsul N.S.B.M. Development of carbon nanotube based biosensor fabrication for medical diagnostics application. / Syamsul N.S.B.M., Nuzaihan M.N.M., Hashim U. // 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1-2. ↑

**C378.** Sadoh T. High-mobility Ge nano-stripes for next generation Si-CMOS. 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1. ↑

**C379.** Dhahi T.S. Fabrication and characterization of a-Si micro and nano-gap structure for electrochemical sensor. / Dhahi T.S., Hashim U., Ahmed N.M., Ali M.E. // 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1-2. ↑

**C380.** Maisurah bt. Mohd Hassan S. A 1.8GHz Voltage-Controlled Oscillator using CMOS technology. / Maisurah bt. Mohd Hassan S., Ismat b. Abdul Rahim A., Razman b. Yahya M. // 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1-2. ↑

**C381.** Maekawa T. Creation of nanostructures via self-assembly at room temperature, cluster structures and dynamics, and bio-nano fusion technology. 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1. ↑

**C382.** Matsui S. Three-dimensional nanostructure fabrication by focused-ion-beam chemical vapor deposition. 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1. ↑

**C383.** Ismail A.F. Nanostructured materials in advanced membrane technology for separation processes. 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1. ↑

**C384.** Othman M. Nanosensors for ubiquitous network. 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1-2. ↑

**C385.** Pandit S. An analytical model for sidewall parasitic capacitance of nano-scale trench isolated MOSFETs. / Pandit S., Sarkar C.K. // 2010 International Conference on Electrical and Computer Engineering (ICECE). - Dhaka, 18-20 Dec. 2010. - P. 578-581. ↑

**C386.** Myong-Jae Yoo. Fabrication of multilayer interconnection materials and bonding film for high integration applications. / Myong-Jae Yoo, Seong-dae Park, Woo Sung Lee, Ha-kin Hwang. // 2010 5th International Microsystems Packaging Assembly and Circuits Technology Conference (IMPACT). - Taipei, 20-22 Oct. 2010. - P. 1-4. ↑

**C387.** Johan Liu. Nanofiber based composites for thermal management. / Johan Liu, Carlberg B. // 2010 5th



International Microsystems Packaging Assembly and Circuits Technology Conference (IMPACT). - Taipei, 20-22 Oct. 2010. - P. 1-2. ↑

C388. Wing Chiu Tam. Systematic defect identification through layout snippet clustering. / Wing Chiu Tam, Poku O., Blanton R.D. // 2010 IEEE International Test Conference (ITC). - Austin, TX, 2-4 Nov. 2010. - P. 1-10. ↑

C389. Tran D.A. Parity prediction synthesis for nano-electronic gate designs. / Tran D.A., Virazel A., Bosio A., Dilillo L., Girard P., Pravossoudovitch S., Wunderlich H. // 2010 IEEE International Test Conference (ITC). - Austin, TX, 2-4 Nov. 2010. - P. 1. ↑

C390. Yi-Ting Cheng. A fine line/space fabrication process on flexible polyimide film using laser direct writing method by photothermal effect of silver nanoparticles. / Yi-Ting Cheng, Rouh-Huey Uang, Kuo-Chan Chiou. // 2010 5th International Microsystems Packaging Assembly and Circuits Technology Conference (IMPACT). - Taipei, 20-22 Oct. 2010. - P. 1-4. ↑

C391. Yu-ren Lin. Interfacial reaction at 250°C in the Sn/Ni-7wt.%V couple. / Yu-ren Lin, Kai-wen Pan, Hsin-jay Wu, Sinn-wen Chen. // 2010 5th International Microsystems Packaging Assembly and Circuits Technology Conference (IMPACT). - Taipei, 20-22 Oct. 2010. - P. 1-4. ↑

C392. Ning-Yuan Wang. Life prediction of high concentration photovoltaic modules subjected to thermal cycling test. / Ning-Yuan Wang, Shih-Ying Chiang, Tsung-Lin Chou, Hsin-Li Lee, Kuo-Ning Chiang. // 2010 5th International Microsystems Packaging Assembly and Circuits Technology Conference (IMPACT). - Taipei, 20-22 Oct. 2010. - P. 1-4. ↑

C393. Yen S.F. Metal-to-metal bonding technology for MEMS application. / Yen S.F., Lin W.S., Hsu C.Y., Lin J.Y. // 2010 5th International Microsystems Packaging Assembly and Circuits Technology Conference (IMPACT). - Taipei, 20-22 Oct. 2010. - P. 1. ↑

C394. Rao B.S.S.C. Determination of tensile properties of lead-free solder joints using nanoindentation. / Rao B.S.S.C., Zeng K.Y., Kripesh V. // 2010 12th Electronics Packaging Technology Conference (EPTC). - Singapore, 8-10 Dec. 2010. - P. 309-314. ↑

C395. Auersperg J. VCCT and integral concepts of bi-material interface fracture in low-k structures-Going to understand relation. / Auersperg J., Dudek R., Michel B. // 2010 12th Electronics Packaging Technology Conference (EPTC). - Singapore, 8-10 Dec. 2010. - P. 632-636. ↑

C396. Qing-Yuan Tang. Fast-response polyimide/multiwall carbon nanotube composite films for monitoring humidity in microelectronic packages. / Qing-Yuan Tang, Chan Y.C. // 2010 12th Electronics Packaging Technology Conference (EPTC). - Singapore, 8-10 Dec. 2010. - P. 265-268. ↑

C397. Vass-Varnai A. An approach for an industrial method for the in-situ characterization of thermal interface materials. / Vass-Varnai A., Sarkany Z., Barna C., Rencz M. // 2010 12th Electronics Packaging Technology Conference (EPTC). - Singapore, 8-10 Dec. 2010. - P. 279-284. ↑

C398. Kim K. From the future Si technology perspective: Challenges and opportunities. 2010 IEEE International Electron Devices Meeting (IEDM). - San Francisco, CA, 6-8 Dec. 2010. - P. 1.1.1-1.1.9. ↑

C399. Yu Cao. Intrinsic variability in nano-CMOS design and beyond. / Yu Cao, Chi-Chao Wang, Yun Ye, Gummalla S., Chakrabarti C. // 2010 IEEE International Electron Devices Meeting (IEDM). - San Francisco, CA, 6-8 Dec. 2010. - P. 17.5.1. ↑

C400. Egelkraut S. Evolution of shear strength and microstructure of die bonding technologies for high temperature applications during thermal aging. / Egelkraut S., Frey L., Knoerr M., Schletz A. // 2010 12th Electronics Packaging Technology Conference (EPTC). - Singapore, 8-10 Dec. 2010. - P. 660-667. ↑

C401. Oppermann M. X-ray computed tomography for nano packaging-a progressive NDE method. / Oppermann M., Zerna T., Wolter K. // 2010 12th Electronics Packaging Technology Conference (EPTC). - Singapore, 8-10 Dec. 2010. - P. 853-858. ↑

C402. Knoerr M. Reliability assessment of sintered nano-silver die attachment for power semiconductors. / Knoerr M., Kraft S., Schletz A. // 2010 12th Electronics Packaging Technology Conference (EPTC). - Singapore, ↑



8-10 Dec. 2010. - P. 56-61.

**C403.** Long Jianyou. Preparation of Uniform and Stable Organic Phase-Change Nano-fluid of Paraffin and Nano-aluminum for Thermal Storage. 2010 International Conference on Digital Manufacturing and Automation (ICDMA). - ChangSha, 18-20 Dec. 2010. - Vol. 2. - P. 110-113. ↑

**C404.** Liu Pengfei. Vibrometer's Measurement Technology in High Temperature. / Liu Pengfei, Guo Tao. // 2010 International Conference on Digital Manufacturing and Automation (ICDMA). - ChangSha, 18-20 Dec. 2010. - Vol. 2. - P. 903-906. ↑

**C405.** Chang E.Y. Ultra-scaled III-V Quantum-Well Field Effect Transistor for THz and post-Si-CMOS digital applications. 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1. ↑

**C406.** Nathan A. Nano-structured large area electronics. 2010 International Conference on Enabling Science and Nanotechnology (ESciNano). - Kuala Lumpur, 1-3 Dec. 2010. - P. 1. ↑

**C407.** Mongia R. Prospective for thermal energy harvesting in mobile computing systems. / Mongia R., Abdelmoneum M. // 2010 International Conference on Energy Aware Computing (ICEAC). - Cairo, 16-18 Dec. 2010. - P. 1-4. ↑

**C408.** Chu-Chung Lee. Metal lift failure modes during fine pitch wire bonding low-k devices with Bond Over Active (BOA) design. / Chu-Chung Lee, Tu Anh Tran, Yin Kheng Au. // 2010 12th Electronics Packaging Technology Conference (EPTC). - Singapore, 8-10 Dec. 2010. - P. 31-36. ↑

**C409.** Modi S. Logic Gate Implementations for Quantum Dot Cellular Automata. / Modi S., Tomar A.S. // 2010 International Conference on Computational Intelligence and Communication Networks (CICN). - Bhopal, 26-28 Nov. 2010. - P. 565-567. ↑

**C410.** Enachescu M. Advanced NEMS-based power management for 3D Stacked Integrated Circuits. / Enachescu M., Voicu G., Cotofana S.D. // 2010 International Conference on Energy Aware Computing (ICEAC). - Cairo, 16-18 Dec. 2010. - P. 1-4. ↑

**C411.** Mazinov A.S. Influence of aperiodicity of nanoscale structures on the resistance. / Mazinov A.S., Bakhov V.A., Karavainikov A.V. // 2010 20th International Crimean Conference Microwave and Telecommunication Technology (CriMiCo). - Sevastopol, 13-17 Sept. 2010. - P. 840-841. ↑

**C412.** Demoustier S. Major achievements of the NANOPACK project. / Demoustier S., Ziaei A. // 2010 16th International Workshop on Thermal Investigations of ICs and Systems (THERMINIC). - Barcelona, 6-8 Oct. 2010. - P. 1-3. ↑

**C413.** Ivanov V.P. Surface magnetostatic wave filters with magnetron sputtered nanoscale films of yttrium iron garnet. / Ivanov V.P., Yakovlev S.V., Nikolaychuk G.A., Demikhova M.V. // 2010 20th International Crimean Conference Microwave and Telecommunication Technology (CriMiCo). - Sevastopol, 13-17 Sept. 2010. - P. 689-690. ↑

**C414.** Prokopenko O.V. Spin-torque magnetic nano-structures as microwave sources. / Prokopenko O.V., Prokopenko L.E., Tiberkevich V.S., Slavin A.N. // 2010 20th International Crimean Conference Microwave and Telecommunication Technology (CriMiCo). - Sevastopol, 13-17 Sept. 2010. - P. 844-845. ↑

**C415.** Maofang Huang. Preparation and antibacterial property evaluation of TiO<sub>2</sub> /nature rubber nanocomposites. / Maofang Huang, Aiwu Ding, Tianming Gao, Mingzhe Lv, Puwang Li. // 2010 3rd International Conference on Biomedical Engineering and Informatics (BMEI). - Yantai, 16-18 Oct. 2010. - Vol. 4. - P. 1714-1718. ↑

**C416.** Saini G. Leakage behavior of underlap FinFET structure: A simulation study. / Saini G., Rana A.K., Pal P.K., Jadav S. // 2010 International Conference on Computer and Communication Technology (ICCCT). - Allahabad, Uttar Pradesh, 17-19 Sept. 2010. - P. 302-305. ↑

**C417.** Huang R. Self-heating effect and characteristic variability of gate-all-around silicon nanowire transistors for highly-scaled CMOS technology (invited). / Huang R., Wang R.S., Zhuge J., Yu T., Ai Y.J., Fan C., Pu S.S., Zou J.B., Wang Y.Y. // 2010 IEEE International SOI Conference (SOI). - San Diego, CA, 11-14 Oct. 2010. - P. ↑



1-4.

**C418.** Imran A. A comparative study of CMOS & CNFET based current conveyor at 32nm technology node. / Imran A., Pable S.D., Hasan M. // 2010 International Conference on Computer and Communication Technology (ICCCT). - Allahabad, Uttar Pradesh, 17-19 Sept. 2010. - P. 276-281. ↑

**C419.** Imran A. High performance optimized CNFET based current conveyor at 32nm technology node. / Imran A., Hasan M., Pable S.D., Akram M.W. // 2010 International Conference on Computer and Communication Technology (ICCCT). - Allahabad, Uttar Pradesh, 17-19 Sept. 2010. - P. 324-329. ↑

**C420.** Rang Toomas. Preface. 2010 12th Biennial Baltic Electronics Conference (BEC). - Tallinn, Estonia, 4-6 Oct. 2010. - P. 3-4. ↑

**C421.** Bhattacharyya P. Methane Detection by MIM Sensor Devices Based on Nano ZnO Thin Films Obtained by Sol-Gel and by Anodization: A Comparative Study. / Bhattacharyya P., Basu P.K., Basu S. // 2010 First International Conference on Sensor Device Technologies and Applications (SENSORDEVICES). - Venice, 18-25 July 2010. - P. 110-115. ↑

**C422.** Chen Chuanzhi. Recognition of Chemical Warfare Agents Based on Nanosensor Array and Probabilistic Neural Network. / Chen Chuanzhi, Zuo Boli, Xiao Yanhua, He Shuijun. // 2010 International Conference on Electrical and Control Engineering (ICECE). - Wuhan, 25-27 June 2010. - P. 5432-5434. ↑

**C423.** Li Su. An Adiabatic Single-Phase MTCMOS Scheme for Leakage Reduction in Nano-Scale CMOS Processes. / Li Su, Jianping Hu. // 2010 International Conference on Electrical and Control Engineering (ICECE). - Wuhan, 25-27 June 2010. - P. 3271-3274. ↑

**C424.** Guigen Zhang. Integrated Micro/Nano Structures as Electrodes in Biosensors. 2010 First International Conference on Sensor Device Technologies and Applications (SENSORDEVICES). - Venice, 18-25 July 2010. - P. 116-119. ↑

**C425.** Sinno A. Enlarged Sample Holder for Optical AFM Imaging: Millimeter Scanning with High Resolution. / Sinno A., Ruaux P., Chassagne L., Topcu S., Alalyli Y., Lerondel G., Blaize S., Bruyant A., Royer P. // 2010 First International Conference on Sensor Device Technologies and Applications (SENSORDEVICES). - Venice, 18-25 July 2010. - P. 190-194. ↑

**C426.** Prokopenko O.V. Microwave planar antennas for telecommunication devices based on magnetic nano-structures (spin-torque nano-oscillators). / Prokopenko O.V., Tiberkevich V.S., Slavin A.N. // 2010 20th International Crimean Conference Microwave and Telecommunication Technology (CriMiCo). - Sevastopol, 13-17 Sept. 2010. - P. 752-753. ↑

**C427.** Kanungo J. Surface Modified Nanoporous Materials for Hydrogen Sensing. / Kanungo J., Basu P.K., Basu S., Spetz A.L. // 2010 First International Conference on Sensor Device Technologies and Applications (SENSORDEVICES). - Venice, 18-25 July 2010. - P. 124-129. ↑

**C428.** Go. Micro Device for Mechanical Evaluation of Axi-symmetric Nanometric Samples: A Feasibility Study. / Go,mez J.A., Ma,rquez-Lucero A. // 2010 First International Conference on Sensor Device Technologies and Applications (SENSORDEVICES). - Venice, 18-25 July 2010. - P. 195-199. ↑

**C429.** Chiariello A.G. Size and temperature effects on the resistance of copper and carbon nanotubes nano-interconnects. / Chiariello A.G., Miano G., Maffucci A. // 2010 IEEE 19th Conference on Electrical Performance of Electronic Packaging and Systems (EPEPS). - Austin, TX, 25-27 Oct. 2010. - P. 97-100. ↑

**C430.** Padovani S. New method for head-up display realization by mean of Chip On Board and Aerosol Jet process. / Padovani S., Sinesi S., Priante S., Antonipieri M., Del Negro A., Zoellmer V., Maiwald M., Hedges M. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-3. ↑

**C431.** Braun T. Water diffusion in micro- and nano-particle filled encapsulants. / Braun T., Georgi L., Bauer J., Koch M., Becker K.-F., Bader V., Aschenbrenner R., Reichl H. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-7. ↑

**C432.** Buetefisch S. New packaging concept for ultra high precision 3D tactile probes for CMM applications. / Buetefisch S., Solzbacher F., Danzebrink H.U., Brand U., Koenders L. // 2010 3rd Electronic System-Integration



Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-4. ↑

C433. Dowhan. Application of multi-criteria optimization algorithms to numerical material extraction of thin layers through nanoindentation technique. / Dowhan, Ł., Wymysłowski A., Janus P., Ekwin, ska M., Wittler O. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-7. ↑

C434. Bonadiman R. Reliability of Ag ink jet printed traces on polyimide substrate. / Bonadiman R., Salazar M.M.P. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-5. ↑

C435. Aasmundtveit K.E. Au-Sn fluxless SLID bonding: Effect of bonding temperature for stability at high temperature, above 400 °C. / Aasmundtveit K.E., Thi Thuy Luu, Hoang-Vu Nguyen, Johannessen R., Hoivik N., Kaiying Wang. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-6. ↑

C436. Hoang-Vu Nguyen. Spherical polymer particles in isotropic conductive adhesives a study on rheology and mechanical aspects. / Hoang-Vu Nguyen, Kristiansen H., Gakkestad J., Johannessen R., Hoivik N., Aasmundtveit K.E. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-6. ↑

C437. Hoivik N. Fluxless wafer-level Cu-Sn bonding for micro- and nanosystems packaging. / Hoivik N., Kaiying Wang, Aasmundtveit K., Salomonsen G., Lapadatu A., Kittilsland G., Stark B. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-5. ↑

C438. Walter H. Influence of moisture on humidity sensitive material parameters of polymers used in microelectronic applications. / Walter H., Dermitzaki E., Wunderle B., Michel B. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-5. ↑

C439. Kaiying Wang. Surface modification and wettability of silicone PDMS film. / Kaiying Wang, Guangming Ouyang, Xuyuan Chen. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-3. ↑

C440. Jakubowska M. Investigation of properties of the SAC solder paste with the silver nanoparticle and carbon nanotube additives and the nano solder joints. / Jakubowska M., Bukat K., Koscielski M., Mlozniak A., Niedzwiedz W., Sloma M., Sitek J. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-6. ↑

C441. Kita S. Nano-slit photonic crystal nanolaser with mode localization in air. / Kita S., Hachuda S., Baba T. // 2010 22nd IEEE International Semiconductor Laser Conference (ISLC). - Kyoto, 26-30 Sept. 2010. - P. 185-186. ↑

C442. Bennemann S. Microstructure and mechanical properties of laser ablation cleaned NiP platings for aluminum wire bonding. / Bennemann S., Dresbach C., Lorenz G., Berthold L., Petzold M. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-5. ↑

C443. Wong C.P. Nano materials for microelectronic packaging. / Wong C.P., Lin W., Zhang R. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-4. ↑

C444. Waegner M. Investigation of nano-patterned PZT thin films by piezoresponse force microscopy. / Waegner M., Haussmann A., Hoffmann M., Suchanek G., Gerlach G., Eng L.M. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-4. ↑

C445. Schmitt W. New silver contact pastes from high pressure sintering to low pressure sintering. / Schmitt W., Heraeus W.C. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-6. ↑

C446. Falat T. Influence of nano silver filler content on properties of ink-jet printed structures for microelectronics. / Falat T., Felba J., Moscicki A., Smolarek A., Bock K., Bonfert D. // 2010 3rd Electronic System-Integration Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-5. ↑

C447. Auersperg J. Crack and damage evaluation in low-k BEO<sub>L</sub> stacks under assembly and CPI aspects. / Auersperg J., Vogel D., Lehr M.U., Grillberger M., Michel B. // 2010 3rd Electronic System-Integration



Technology Conference (ESTC). - Berlin, 13-16 Sept. 2010. - P. 1-4. ↑

C448. Cai Zhihai. Green manufacturing technologies of CrTiAlN composite coatings as an alternative to chromium electroplating for piston rings. / Cai Zhihai, Zhang Ping, Zhao Junjun, Du Jun. // 5th International Conference on Responsive Manufacturing-Green Manufacturing (ICRM 2010). - Ningbo, 11-13 Jan. 2010. - P. 370-374. ↑

C449. Kangarloo H. Comparison of nano-structures of LIF coated on Steel and Ceramic substrates. / Kangarloo H., Rafizadeh S., Farhangmehr M. // 2010 2nd International Conference on Mechanical and Electrical Technology (ICMET). - Singapore, 10-12 Sept. 2010. - P. 745-747. ↑

C450. {no data available}. Covers. 2010 2nd International Conference on Mechanical and Electrical Technology (ICMET). - Singapore, 10-12 Sept. 2010. - P. c1-c4. ↑

C451. Zhankun Weng. Fabrication of the InP nanopillars. / Zhankun Weng, Lanjiao Liu, Jia Xu, Zhengxun Song, Zuobin Wang. // 2010 2nd International Conference on Mechanical and Electrical Technology (ICMET). - Singapore, 10-12 Sept. 2010. - P. 569-573. ↑

C452. Kangarlou H. Studying the nano structures of Titanium dioxide multilayer produced with gold nano particles depletion in extreme vacuum condition. / Kangarlou H., Rafizadeh S. // 2010 2nd International Conference on Mechanical and Electrical Technology (ICMET). - Singapore, 10-12 Sept. 2010. - P. 627-630. ↑

C453. Yacob A.R. Physical and basic strength of prepared nano structured MgO. / Yacob A.R., Mustajab M.K.A.A., Samadi N.S. // 2010 2nd International Conference on Mechanical and Electrical Technology (ICMET). - Singapore, 10-12 Sept. 2010. - P. 20-23. ↑

C454. Heubach D. Analysing the technology relevance of nanotechnology in product planning. / Heubach D., Warschat J. // 2010 Proceedings of PICMET '10: Technology Management for Global Economic Growth (PICMET). - Phuket, 18-22 July 2010. - P. 1-11. ↑

C455. Afanasiev A. Use of technology roadmapping in selecting projects for financial support. / Afanasiev A., Khakhanov Y. // 2010 Proceedings of PICMET '10: Technology Management for Global Economic Growth (PICMET). - Phuket, 18-22 July 2010. - P. 1-30. ↑

C456. Hata S. Nano-level 3-D shape measurement method from analysis of interference fringes using RGB LED lightings. / Hata S., Kaneda M., Kimura D., Morimoto S., Iwamoto M., Kobayashi H. // Proceedings of SICE Annual Conference 2010. - Taipei, 18-21 Aug. 2010. - P. 1214-1217. ↑

C457. Olorunniwo O. GPS, Galileo, and nanotechnology: A cost-effective satellite technology?. / Olorunniwo O., Olorunniwo M. // 2010 Proceedings of PICMET '10: Technology Management for Global Economic Growth (PICMET). - Phuket, 18-22 July 2010. - P. 1-10. ↑

C458. Zongliang Cao. MEMS structures using polycrystalline diamond single-material micro technologies. / Zongliang Cao, Aslam D. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 557-560. ↑

C459. Zaijun Cheng. The design optimization for GaN-based betavoltaic microbattery. / Zaijun Cheng, Haisheng San, Yanfei Li, Xuyuan Chen. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 582-586. ↑

C460. Jiangang Zhang. Formation of the nano-scale archipelago shape upper electrode of capacitive humidity sensor. / Jiangang Zhang, Xiaoyang Zhu, Zhen Fang, Zhan Zhao. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 836-839. ↑

C461. Ruilin Ma. Fabrication of Micro/Nano-filter by building sacrificial structure with colloid crystal. / Ruilin Ma, Wei Wang, Wengang Wu. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 765-768. ↑

C462. Farahbakhsh I. Mechano-chemical synthesis of nano leaded brass from oxidized raw materials and the effect of milling time. / Farahbakhsh I., Farahbakhsh A., Ramazani O., Farahbakhsh A., Sohrabi S. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 1165-1169. ↑



- C463.** Camuc. Neocortical frame-free vision sensing and processing through scalable Spiking ConvNet hardware. / Camuc,as-Mesa L., Pe,rez-Carrasco J.A., Zamarrec,o-Ramos C., Serrano-Gotarredona T., Linares-Barranco B. // The 2010 International Joint Conference on Neural Networks (IJCNN). - Barcelona, 18-23 July 2010. - P. 1-8. ↑
- C464.** Guowei Xiu. Nanolocalization of features in the patterns produced by Four-beam Laser Interference Lithography. / Guowei Xiu, Zhengxun Song, Zhen Hu, Zhankun Weng. // 2010 2nd International Conference on Mechanical and Electrical Technology (ICMET). - Singapore, 10-12 Sept. 2010. - P. 130-134. ↑
- C465.** Fu Shi. Analysis of magnetic latching mechanism in the application of bi-stable MEMS switches. / Fu Shi, Tang Xuehua, Wu Yibo. // 2010 5th IEEE International Conference on Nano/Micro Engineered and Molecular Systems (NEMS). - Xiamen, 20-23 Jan. 2010. - P. 1044-1047. ↑
- C466.** Zebo Peng. Building reliable embedded systems with unreliable components. 2010 International Conference on Signals and Electronic Systems (ICSES). - Gliwice, 7-10 Sept. 2010. - P. 9-13. ↑
- C467.** Wolinski T.R. Photonic liquid crystal fibers: Towards highly tunable photonic devices. / Wolinski T.R., Budaszewski D., Chychlowski M., Czapla A., Ertman S., Lesiak P., Rutkowska K., Sierakowski M., Tefelska M., Domanski A.W. // 2010 International Conference on Photonics (ICP). - Langkawi, Kedah, 5-7 July 2010. - P. 1-5. ↑
- C468.** Doostaregan A. On the design of new low-power CMOS standard ternary logic gates. / Doostaregan A., Moaiyeri M.H., Navi K., Hashemipour O. // 2010 15th CSI International Symposium on Computer Architecture and Digital Systems (CADSD). - Tehran, 23-24 Sept. 2010. - P. 115-120. ↑
- C469.** Muhammad M. An ESD design automation framework and tool flow for nano-scale CMOS technologies. / Muhammad M., Gauthier R., Junjun Li, Ginawi A., Montstream J., Mitra S., Chatty K., Joshi A., Henderson K., Palmer N., Hulse B. // 2010 32nd Electrical Overstress/ Electrostatic Discharge Symposium (EOS/ESD). - Reno, NV, 3-8 Oct. 2010. - P. 1-6. ↑
- C470.** Esman A.K. Periodic nano- and microstructures for reception and transmission of information of the terahertz range. / Esman A.K., Kuleshov V.K., Zykov G.L., Zalesski V.B., Kravchenko V.M., Stepanov B.I. // 2010 2nd IEEE International Workshop Thz Radiation (TERA). - Sevastopol, 12-14 Sept. 2010. - P. 285-287. ↑
- C471.** Benini L. Designing many-core platforms for silicon-efficient embedded multimedia computing. 2010 15th CSI International Symposium on Computer Architecture and Digital Systems (CADSD). - Tehran, 23-24 Sept. 2010. - P. XV. ↑
- C472.** Bajwa H. Nanostructured conformable patch antenna array. / Bajwa H., Patra P., Ikram A.A., Mirza J. // 2010 International Conference on Information and Emerging Technologies (ICIET). - Karachi, 14-16 June 2010. - P. 1-4. ↑
- C473.** Lymberis A. Converging micro-nano-bio technologies towards integrated in-vitro testing systems: Current activities and future challenges under the EU-Information & communication technologies program. 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). - Buenos Aires, Aug. 31 2010-Sept. 4 2010. - P. 295-297. ↑
- C474.** Menciassi A. From miniature to nano robots for diagnostic and therapeutic applications. / Menciassi A., Sinibaldi E., Pensabene V., Dario P. // 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). - Buenos Aires, Aug. 31 2010-Sept. 4 2010. - P. 1954-1957. ↑
- C475.** Brown L. A low-power, wireless, 8-channel EEG monitoring headset. / Brown L., van de Molengraft J., Yazicioglu R.F., Torfs T., Penders J., Van Hoof C. // 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). - Buenos Aires, Aug. 31 2010-Sept. 4 2010. - P. 4197-4200. ↑
- C476.** S. Textile-templated electrospun anisotropic scaffolds for tissue engineering and regenerative medicine. / Senel-Ayaz H.G., Perets A., Govindaraj M., Brookstein D., Lelkes P.I. // 2010 Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). - Buenos Aires, Aug. 31 2010-Sept. 4 2010. - P. 255-258. ↑
- C477.** Sahlstrom T.D. Space flight experiment: Advanced solar cells and protective materials on the ISS



exterior. / Sahlstrom T.D., Hausgen P.E., Wilt D.M., Howard A.D., Anderson M.D., Snyder N.A. // 2010 35th IEEE Photovoltaic Specialists Conference (PVSC). - Honolulu, HI, 20-25 June 2010. - P. 002610-002615. ↑

C478. Pattnaik S. Amorphous silicon sola cells on plastic based photonic structures. / Pattnaik S., Biswas R., Dalal V.L., Slafer D., Jin Ji. // 2010 35th IEEE Photovoltaic Specialists Conference (PVSC). - Honolulu, HI, 20-25 June 2010. - P. 001483-001486. ↑

C479. Kovac U. A novel approach to the statistical generation of non-normal distributed PSP compact model parameters using a nonlinear power method. / Kovac U., Dideban D., Cheng B., Moezi N., Roy G., Asenov A. // 2010 International Conference on Simulation of Semiconductor Processes and Devices (SISPAD). - Bologna, 6-8 Sept. 2010. - P. 125-128. ↑

C480. Shaker G. Integrated antenna with inkjet-printed compact artificial magnetic surface for UHF applications. / Shaker G., Lee H., Duncan K., Tentzeris M. // 2010 IEEE International Conference on Wireless Information Technology and Systems (ICWITS). - Honolulu, HI, Aug. 28 2010-Sept. 3 2010. - P. 1-4. ↑

C481. Zhao Min. Investigation and analysis of a MOEMS gyroscope based on novel resonator. / Zhao Min, Yan Shubin, Yan Yingzhan, Jia Pengfei, Liu Zheng, Li Jie, Liu Jun. // 2010 10th Russian-Chinese Symposium on Laser Physics and Laser Technologies (RCSLPLT) and 2010 Academic Symposium on Optoelectronics Technology (ASOT). - Harbin, July 28 2010-Aug. 1 2010. - P. 337-340. ↑

C482. Prefasi E. A 0.08 mm<sup>2</sup>, 7mW Time-Encoding Oversampling Converter with 10 bits and 20MHz BW in 65nm CMOS. / Prefasi E., Paton S., Hernandez L., Gaggi R., Wiesbauer A., Hauptmann J. // 2010 Proceedings of the ESSCIRC. - Seville, 14-16 Sept. 2010. - P. 430-433. ↑

C483. Young I.A. Analog mixed-signal circuits in advanced nano-scale CMOS technology for microprocessors and SoCs. 2010 Proceedings of the ESSCIRC. - Seville, 14-16 Sept. 2010. - P. 61-70. ↑

C484. Swaminathan M. Advanced polymers for advanced RF packaging applications. / Swaminathan M., Altunyurt N., Seunghyun Hwang. // 2010 European Microwave Conference (EuMC). - Paris, 28-30 Sept. 2010. - P. 695-698. ↑

C485. Ahrenkiel R.K. A new lifetime diagnostic system for photovoltaic materials. / Ahrenkiel R.K., Dunlavy D.J., Simonds B. // 2010 35th IEEE Photovoltaic Specialists Conference (PVSC). - Honolulu, HI, 20-25 June 2010. - P. 000842-000846. ↑

C486. Naigui Shang. Direct catalytic growth of high-density carbon nanotubes on nanoclusters at low temperatures. / Naigui Shang, Chen G.Y., Tan Y.Y., Stolojan V., Papakonstantinou P., Silva S.R.P. // 2010 8th International Vacuum Electron Sources Conference and Nanocarbon (IVESC). - Nanjing, 14-16 Oct. 2010. - P. 389. ↑

C487. Yan Wang. Bistable resistance switching of Cu/Cu: HfO<sub>2</sub> /Pt for nonvolatile memory application. / Yan Wang, Shi-Bing Long, Hang-Bing Lv, Qi Liu, Qin Wang, Ying-Tao Li, Sen Zhang, Wen-Tai Lian, Jian-Hong Yang, Ming Liu. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1118-1120. ↑

C488. Ying-Tao Li. A low-cost memristor based on titanium oxide. / Ying-Tao Li, Shi-Bing Long, Hang-Bing Lv, Qi Liu, Qin Wang, Yan Wang, Sen Zhang, Wen-Tai Lian, Su Liu, Ming Liu. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1148-1150. ↑

C489. Endoh T. Future High density Memory with Vertical structured device technology. 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1051-1054. ↑

C490. Wen-Tai Lian. Multilevel storage characteristics in ZrO<sub>2</sub> -ReRAM brought about by ideal current limiter. / Wen-Tai Lian, Shi-Bing Long, Hang-Bing Lv, Qi Liu, Ying-Tao Li, Yan Wang, Sen Zhang, Yue-Hua Dai, Jun-ning Chen, Ming Liu. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1112-1114. ↑

C491. Balocco C. Novel Terahertz nanodevices and circuits. / Balocco C., Kasjoo S.R., Xiaofeng Lu, Linqing Zhang, Alimi Y., Winnerl S., Peng Bao, Yi Luo, Kin Lee, Song A.M. // 2010 10th IEEE International Conference



on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1176-1179. ↑

C492. Mizuta H. Scaled silicon nanoelectromechanical (NEM) hybrid systems. / Mizuta H., Garcia-Ramirez M.A., Hassani F.A., Ghiass M.A., Kalhor N., Moktadir Z., Tsuchiya Y., Sawai S., Ogi J., Oda S. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1198-1201. ↑

C493. Shi-Bing Long. Resistive switching mechanism of Cu doped ZrO<sub>2</sub>-based RRAM. / Shi-Bing Long, Qi Liu, Hang-Bing Lv, Ying-Tao Li, Yan Wang, Sen Zhang, Wen-Tai Lian, Ming Liu. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1163-1165. ↑

C494. Uraoka Y. New functional devices fabricated by bio nano process. / Uraoka Y., Yamashita I. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1172-1175. ↑

C495. Jiao G.F. Investigation of tunneling field effect transistor reliability. / Jiao G.F., Huang X.Y., Chen Z.X., Cao W., Huang D.M., Yu H.Y., Singh N., Lo G.Q., Kwong D., Ming-Fu Li. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1612-1615. ↑

C496. Mansun Chan. 3-D matrix nano-wire transistor fabrication on silicon substrate. / Mansun Chan, Ng R.M.Y., Tao Wang, Xuan Zuo, Jin He. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 883-886. ↑

C497. Yanpin Li. Application of nanotechnology on hydraulic turbine abrasion and erosion. / Yanpin Li, Junpeng Ma, Weifeng Yu. // 2010 International Conference on Power System Technology (POWERCON). - Hangzhou, 24-28 Oct. 2010. - P. 1-3. ↑

C498. Senami M. Quantum chemical approaches to the electronic structures of nano-electronics materials. / Senami M., Tachibana A. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1765-1768. ↑

C499. Ke-Jia Qian. Preparation and characterization of low-dielectric-constant F-doped SiOCN films by PECVD. / Ke-Jia Qian, Qing-Qing Sun, Shi-Jin Ding, Wei Zhang. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1003-1005. ↑

C500. He Y. DNA Sequencing with nanopore-embedded bilayer-graphene nanoelectrodes. / He Y., Scheicher R., Grigoriev A., Ahuja R., Long S., Huo Z., Ming Liu. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1483-1485. ↑

C501. Gang Zhang. Direct observation of channel hot-electron energy in short-channel metal-oxide-semiconductor field-effect transistors. / Gang Zhang, Cheng Yang, Hua-Min Li, Tian-zi Shen, Won Jong Yoo. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 894-896. ↑

C502. Jian Xin Shen. Ge/SiO<sub>2</sub> low temperature wafer bonding. / Jian Xin Shen, Xuan Xiong Zhang, Tian Chun Ye, Songlin Zhuang. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1557-1559. ↑

C503. Liow J. Silicon photonics technologies for monolithic electronic-photon integrated circuit applications. / Liow J., Ming-Bin Yu, Lo P., Dim-Lee Kwong. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 29-32. ↑

C504. Cheung K.P. Wafer-level magnetotransport measurement of advanced transistors-making a powerful technique even more powerful. / Cheung K.P., Campbell J.P., Yu L. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 17-20. ↑

C505. Fu-Liang Yang. Outlook for 15nm CMOS research technologies. / Fu-Liang Yang, Hou-Yu Chen, Chien-Chao Huang. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 62-65. ↑



- C506.** Jia-Min Shieh. Potential application of thin-film nanotechnologies in third-generation Si solar cells. / Jia-Min Shieh, Chang-Hong Shen, Ting-Jen Hsueh, Wen-Hsien Huang, Bau-Tong Dai, Fu-Liang Yang. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1990-1993. ↑
- C507.** Khasanov O. Influence of powerful ultrasonic treatment on the structure of dry ceramic nanopowders. / Khasanov O., Dvilis E., Kachaev A., Khasanov A. // 2010 International Forum on Strategic Technology (IFOST). - Ulsan, 13-15 Oct. 2010. - P. 50-52. ↑
- C508.** Jin Taek Choi. Functionalized graphene sheet/polyurethane nanocomposites: Effect of particle size on the physical properties. / Jin Taek Choi, Kwang Sun Ryu, Hyung-il Lee, Han Mo Jeong, Cheol Min Shin, Jung Ho Kim. // 2010 International Forum on Strategic Technology (IFOST). - Ulsan, 13-15 Oct. 2010. - P. 334-336. ↑
- C509.** Wang Z.L. Self-powered nanosystem: From nanogenerators to piezotronics. 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 4. ↑
- C510.** Wenmin Guo. DC voltage current characteristic of Silicon Carbide/ low-density polyethylene composites. / Wenmin Guo, Baozhong Han, Zhonghua Li. // 2010 International Forum on Strategic Technology (IFOST). - Ulsan, 13-15 Oct. 2010. - P. 365-368. ↑
- C511.** ChiaHua Ho. A flexible, highly-sensitive, and easily-fabricated carbon-nanotubes tactile sensor on polymer substrate. / ChiaHua Ho, Wang-Shen Su, Chih-Fan Hu, Chia-Min Lin, Weileun Fang, Fu-Liang Yang. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1388-1391. ↑
- C512.** Zhuoyu Ji. Detecting the interface state of organic thin-film transistors through hysteresis characteristics. / Zhuoyu Ji, Lijuan Zhen, Liwei Shang, Ming Liu, Hong Wang, Xin Liu, Maixing Han. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1295-1297. ↑
- C513.** Chu P.K. Plasma immersion ion implantation: From microelectronics to biomedical engineering. 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1222. ↑
- C514.** Gessner T. Micro/nano technologies towards smart systems integration. / Gessner T., Vogel M., Kaufmann C., Hiller K., Kurth S., Nestler J., Otto T. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1396-1399. ↑
- C515.** Wen Huang. Theoretical study on geometry and temperature effects of thermoelectric properties of Si and Ge nanowires. / Wen Huang, Chee Shin Koong, Gengchiao Liang. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1832-1834. ↑
- C516.** Gang Du. Study of 20nm bulk FINFET by using 3D full band Monte Carlo method with Effective Potential Quantum Correction. / Gang Du, Wei Zhang, Juncheng Wang, Tiao Lu, Pingwen Zhang, Xiaoyan Liu. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1952-1954. ↑
- C517.** Yao Yin. InGaN/GaN multi-quantum-well nanowires and light emitting. / Yao Yin, Ruihua Cao, Peng Chen, Qing Wan, Lin Pu, Yi Shi, Rong Zhang, Youdou Zheng. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1362-1364. ↑
- C518.** Fujishiro H.I. Impact of electron rebound from drain on drive current in nano-scale InGaAs MOSFETs. / Fujishiro H.I., Watanabe H., Homma T., Hara S. // 2010 10th IEEE International Conference on Solid-State and Integrated Circuit Technology (ICSICT). - Shanghai, 1-4 Nov. 2010. - P. 1350-1352. ↑
- C519.** Chuan-hui Liu. Study on preparation of electro less nickel plating on the surface of nano-fullerene crystals. / Chuan-hui Liu, Zhong Liang. // 2010 International Conference on Future Information Technology and Management Engineering (FITME). - Changzhou, 9-10 Oct. 2010. - Vol. 3. - P. 112-114. ↑
- C520.** Shihua Zhou. An image encryption algorithm based on DNA self-assembly technology. / Shihua Zhou,



Qiang Zhang, Xiaopeng Wei. // 2010 IEEE International Conference on Intelligent Computing and Intelligent Systems (ICIS). - Xiamen, 29-31 Oct. 2010. - Vol. 2. - P. 315-319. ↑

C521. Mazidi E. Designing current mirror with Nano wire FET. 2010 IEEE Nanotechnology Materials and Devices Conference (NMDC). - Monterey, CA, 12-15 Oct. 2010. - P. 339-342. ↑

C522. Sautner J. Functional 3-D magnetic nanostructures. / Sautner J., Jayapratha N., Metlushko V. // 2010 International Conference on Electromagnetics in Advanced Applications (ICEAA). - Sydney, NSW, 20-24 Sept. 2010. - P. 547-548. ↑

C523. Zhang Xiaochen. Thermal Analysis of High Speed PM Generator used for distributed generation system. / Zhang Xiaochen, Li Weili, Cheng Shukang, Kou Baoquan, Geng Jiamin, Wang Jing. // 2010 International Conference on Power System Technology (POWERCON). - Hangzhou, 24-28 Oct. 2010. - P. 1-7. ↑

C524. Luning Xu. Modeling and simulation of anode-supported planar intermediate temperature solid oxide fuel cell for integrated gasification fuel cell application. / Luning Xu, Li Han, Zuomin Dong. // 2010 International Conference on Power System Technology (POWERCON). - Hangzhou, 24-28 Oct. 2010. - P. 1-7. ↑

C525. Freilikhman A. Unguided optical bus for next-generation computers: Simulation of the motherboard. / Freilikhman A., Arnon S. // 2010 IEEE 26th Convention of Electrical and Electronics Engineers in Israel (IEEEI). - Eliat, 17-20 Nov. 2010. - P. 000906-000910. ↑

C526. Shiri A. Query reformulation strategies in an interdisciplinary digital library: The case of nanoscience and technology. 2010 Fifth International Conference on Digital Information Management (ICDIM). - Thunder Bay, ON, 5-8 July 2010. - P. 200-206. ↑

C527. Yu Liu. Towards cool and reliable digital systems: RT level CED techniques with runtime adaptability. / Yu Liu, Kaijie Wu. // 2010 IEEE International Conference on Computer Design (ICCD). - Amsterdam, 3-6 Oct. 2010. - P. 528-533. ↑

C528. Patooghy A. Crosstalk modeling to predict channel delay in Network-on-Chips. / Patooghy A., Miremadi S.G., Shafaei M. // 2010 IEEE International Conference on Computer Design (ICCD). - Amsterdam, 3-6 Oct. 2010. - P. 396-401. ↑

C529. Shen L. First principles prediction of materials for spintronics: From bulk to nano. / Shen L., Zeng M.G., Pan H., Lim C.C., Lu Y.H., Xu B., Sun J.T., Yi J.B., Yang K.S., Feng Y.P., Ding J., Yang S.W., Dai Y., Wee A., Lin J.Y. // 2010 8th International Vacuum Electron Sources Conference and Nanocarbon (IVESC). - Nanjing, 14-16 Oct. 2010. - P. 129-130. ↑

C530. Zhong Lin Wang. Nanogenerator and nano-piezotronics. 2010 8th International Vacuum Electron Sources Conference and Nanocarbon (IVESC). - Nanjing, 14-16 Oct. 2010. - P. 3. ↑

C531. Mach P. Thermal ageing of electrically conductive micro/nano adhesives. / Mach P., Bus,ek D. // 2010 IEEE 16th International Symposium for Design and Technology in Electronic Packaging (SIITME). - Pitesti, 23-26 Sept. 2010. - P. 89-92. ↑

C532. Abu-Nimeh F.T. Electro-magnetic sensing and actuation array on silicon substrate platforms. / Abu-Nimeh F.T., Salem F.M. // 2010 IEEE Nanotechnology Materials and Devices Conference (NMDC). - Monterey, CA, 12-15 Oct. 2010. - P. 119-122. ↑

C533. Imeci S.T. S-band TCR patch antenna design for nano satellites. / Imeci S.T., Apaydin Z., Demircioglu E., Sazli M.H. // 2010 IEEE 18th Signal Processing and Communications Applications Conference (SIU). - Diyarbakir, 22-24 April 2010. - P. 657-660. ↑

C534. {no data available}. Session MNT: Micro and nano technology 1. 2010 International Semiconductor Conference (CAS). - Sinaia, Romania, 11-13 Oct. 2010. - Vol. 01. - P. 229. ↑

C535. Karssemeijer N. Integrating biological knowledge, novel imaging modalities, and modeling in breast cancer diagnosis. / Karssemeijer N., Huisman H., Hawkes D., Hipwell J., Bohler T., Lesniak J., Tanner C., Szekely G., Niessen W., Hahn H. // 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 386-389. ↑



- C536.** Watton P.N. An integrative approach to cerebrovascular disease healthcare: IT for cerebral aneurysms. / Watton P.N., Frangi A., Ventikos Y. // 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 378-381. ↑
- C537.** Kawanaka J. Development of high power Yb:YAG pump source for few-cycle pulse amplification. / Kawanaka J., Yasuhara R., Takeuchi Y., Pearce S.J., Kawashima T., Kan H. // Lasers and Electro-Optics 2009 and the European Quantum Electronics Conference. CLEO Europe-EQEC 2009. European Conference on. - Munich, 14-19 June 2009. - P. 1. ↑
- C538.** Ghibaudo G. Electrical transport characterization of nano CMOS devices with ultra-thin silicon film. / Ghibaudo G., Mouis M., Pham-Nguyen L., Bennamane K., Pappas I., Cros A., Bidal G., Fleury D., Claverie A., Benassayag G., Fazzini P.-F., Fenouillet-Beranger C., Monfray S., Boeuf F., Cristoloveanu S., Skotnicki T., Collaert N. // 2009. IWJT 2009. International Workshop on Junction Technology. - Kyoto, 11-12 June 2009. - P. 58-63. ↑
- C539.** Bensch R. Image analysis of Arabidopsis trichome patterning in 4D confocal datasets. / Bensch R., Ronneberger O., Greese B., Fleck C., Wester K., Hulskamp M., Burkhardt H. // 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 742-745. ↑
- C540.** Crookes D. GPU implementation of map-MRF for microscopy imagery segmentation. / Crookes D., Miller P., Gribben H., Gillan C., McCaughey D. // 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 526-529. ↑
- C541.** Yu-Shi Lin. Feature space transformation for semi-supervised learning for protein subcellular localization in fluorescence microscopy images. / Yu-Shi Lin, Yi-Hung Huang, Chung-Chih Lin, Chun-Nan Hsu. // 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 414-417. ↑
- C542.** Okida M. Nano-particles transportation using a holographic multiple-vortex tweezer. / Okida M., Akabane T., Kanomata K., Omatsu T. // Lasers and Electro-Optics 2009 and the European Quantum Electronics Conference. CLEO Europe-EQEC 2009. European Conference on. - Munich, 14-19 June 2009. - P. 1. ↑
- C543.** Yung-Jin Weng. Automatic Positioning Device Design for the Operation Platform of Nano-indentation. / Yung-Jin Weng, Yung-Chun Weng, Huang-Sheng Fang, Yong-Cheng Wong, Chih-Yu Ke, Hsu-Kang Liu. // 2009 International Conference on Signal Processing Systems. - Singapore, 15-17 May 2009. - P. 913-916. ↑
- C544.** Yung-Jin Weng. Fabrication of Microlens Arrays by Using Nano-Particle Fluid Imprinting Technology. / Yung-Jin Weng, Yung-Chun Weng, Jen-Ching Huang, Yong-Cheng Wong, Sen-Yeu Yang, Hsu-Kang Liu. // 2009 International Conference on Signal Processing Systems. - Singapore, 15-17 May 2009. - P. 963-966. ↑
- C545.** Yung-Jin Weng. A Novel Magnetic Nickel Mold Combined Nano-Particle Fluid Electromagnetism Imprinting on Replicating Microstructures. / Yung-Jin Weng, Yung-Chun Weng, Yong-Cheng Wong, Sen-Yeu Yang. // 2009 International Conference on Signal Processing Systems. - Singapore, 15-17 May 2009. - P. 967-970. ↑
- C546.** Campbell J.P. Large random telegraph noise in sub-threshold operation of nano-scale nMOSFETs. / Campbell J.P., Yu L.C., Cheung K.P., Qin J., Suehle J.S., Oates A., Sheng K. // 2009. ICICDT 09. IEEE International Conference on IC Design and Technology. - Austin, TX, 18-20 May 2009. - P. 17-20. ↑
- C547.** Bhuyan M.K. Femtosecond micromachining of high aspect ratio structures in fused silica using Bessel beams. / Bhuyan M.K., Courvoisier F., Lacourt P.-A., Jacquot M., Furfaro L., Withford M.J., Dudley J.M. // Lasers and Electro-Optics 2009 and the European Quantum Electronics Conference. CLEO Europe-EQEC 2009. European Conference on. - Munich, 14-19 June 2009. - P. 1. ↑
- C548.** Shah S.C. Speckled Computing: Evolution and Challenges. / Shah S.C., Chandio F.H., Myong-Soon Park. // 2009 International Conference on Future Networks. - Bangkok, 7-9 March 2009. - P. 181-185. ↑
- C549.** Karatas Y. The place of small satellites in fulfilling the Earth observation requirements of a developing country. / Karatas Y., Ince F. // 2009. RAST '09. 4th International Conference on Recent Advances in Space Technologies. - Istanbul, 11-13 June 2009. - P. 333-339. ↑



- C550.** Dayton P.A. Improving technology for molecular imaging with ultrasound. 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 751-753. ↑
- C551.** Vial J. Yes, we can improve SoC yield. / Vial J., Virazel A. // 2009. PRIME 2009. Ph.D. Research in Microelectronics and Electronics. - Cork, 12-17 July 2009. - P. 272-275. ↑
- C552.** Shiraishi K. Guiding principles toward future gate stacks given by the construction of new physical concepts. 2009 Symposium on VLSI Technology. - Honolulu, HI, 16-18 June 2009. - P. 196-197. ↑
- C553.** Junrong Liang. Distribution of Antioxidases in Cell of Diatom *Nitzschia Closterium* and Response to Different Environmental Silicon Concentrations. / Junrong Liang, Jiang Zheng, Xin Zhao. // 2009. ESIAT 2009. International Conference on Environmental Science and Information Application Technology. - Wuhan, 4-5 July 2009. - Vol. 1. - P. 545-548. ↑
- C554.** Liu Qing-gang. Fabrication and Characterization of Micro Opto-electronic Sensor. / Liu Qing-gang, Yan Zhi-hong, Zhao Ling, Lou Xiao-na, Hu Xiao-tang. // 2009. ICMTMA '09. International Conference on Measuring Technology and Mechatronics Automation. - Zhangjiajie, Hunan, 11-12 April 2009. - Vol. 1. - P. 20-23. ↑
- C555.** Sinnadurai N. Electronics and its impact on energy and the environment. / Sinnadurai N., Charles H.K. // 2009. ISSE 2009. 32nd International Spring Seminar on Electronics Technology. - Brno, 13-17 May 2009. - P. 1-10. ↑
- C556.** Malewicz M. Synthesis of zinc oxide nanotiles by wet chemical route assisted by microwave heating. / Malewicz M., Byrczek M., Teterycz H. // 2009. ISSE 2009. 32nd International Spring Seminar on Electronics Technology. - Brno, 13-17 May 2009. - P. 1-4. ↑
- C557.** Hashim U. Design of digital display system for ISFET pH sensor by using PIC microcontroller Unit (MCU). / Hashim U., Haron M.N. // 2009. ASQED 2009. 1st Asia Symposium on Quality Electronic Design. - Kuala Lumpur, 15-16 July 2009. - P. 148-152. ↑
- C558.** Polasek O. P2P in public health: From particles to populations. / Polasek O., Fister K., Vuletic S., Kern J. // 2009. ITI 09. Proceedings of the ITI 2009 31st International Conference on Information Technology Interfaces. - Dubrovnik, 22-25 June 2009. - P. 93-98. ↑
- C559.** Maltz J.S. Fixed gantry tomosynthesis system for radiation therapy image guidance based on a multiple source x-ray tube with carbon nanotube cathodes. / Maltz J.S., Fuerst J., Paidi A., Fadler F., Bani-Hashemi A.R., Sprenger F. // 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 1239-1242. ↑
- C560.** Wang L.V. Photoacoustic tomography: High-resolution imaging of optical contrast in vivo at superdepths. 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 1201. ↑
- C561.** Lange N. The role and development of technology to advance brain science. 2009. ISBI '09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, USA, June 28 2009-July 1 2009. - P. 823. ↑
- C562.** Powell K. Biomedical imaging ecosystem and the role of the GPU. 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 1291-1292. ↑
- C563.** Helal M. Topology Optimization of a Three-Dimension Compliant Microgripper Using Multi-objective Compliance. / Helal M., Liguó Chen, Lining Sun, Tao Chen. // 2009. CASE 2009. IITA International Conference on Control, Automation and Systems Engineering. - Zhangjiajie, 11-12 July 2009. - P. 124-127. ↑
- C564.** Kurugol S. Localizing the dermis/epidermis boundary in reflectance confocal microscopy images with a hybrid classification algorithm. / Kurugol S., Dy J.G., Rajadhyaksha M., Brooks D.H. // 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 1322-1325. ↑
- C565.** Kaeli D.R. Profile-guided optimization of critical medical imaging algorithms. / Kaeli D.R., Byunghyun



Jang, Mistry P., Schaa D. // 2009. ISBI 09. IEEE International Symposium on Biomedical Imaging: From Nano to Macro. - Boston, MA, June 28 2009-July 1 2009. - P. 1293. ↑

C566. Geunho Cho. Performance evaluation of CNFET-based logic gates. / Geunho Cho, Yong-Bin Kim, Lombardi F., MinSu Choi. // 2009. I2MTC 09. IEEE Instrumentation and Measurement Technology Conference. - Singapore, 5-7 May 2009. - P. 909-912. ↑

C567. Afsar M.N. Microwave permittivity and permeability properties and microwave reflections of micro/nano ferrite powders. / Afsar M.N., Sharma A., Obol M. // 2009. I2MTC 09. IEEE Instrumentation and Measurement Technology Conference. - Singapore, 5-7 May 2009. - P. 274-278. ↑

C568. Rinaldi M. AIN contour-mode resonators for narrow-band filters above 3 GHz. / Rinaldi M., Zuniga C., Chengjie Zuo, Piazza G. // 2009 Joint with the 22nd European Frequency and Time forum. IEEE International Frequency Control Symposium. - Besancon, 20-24 April 2009. - P. 70-74. ↑

C569. Chaudhary S. Probabilistic analysis of design mapping in asynchronous nanowire crossbar architecture. / Chaudhary S., Minsu Choi, Yong-Bin Kim. // 2009. I2MTC 09. IEEE Instrumentation and Measurement Technology Conference. - Singapore, 5-7 May 2009. - P. 1116-1120. ↑

C570. Seddon A.B. Tg : The glass door to photonic devices and integrated circuits. / Seddon A.B., Lian Z.G., Pan W.J., Furniss D., Benson T.M. // 2009. ICTON 09. 11th International Conference on Transparent Optical Networks. - Azores, June 28 2009-July 2 2009. - P. 1-4. ↑

C571. Ambrosio M. Nano-materials and nano-technologies for novel photon detection systems. / Ambrosio M., Aramo C., Carillo V., Ambrosio A., Guarino F., Maddalena P., Esposito E., Grossi V., Passacantando M., Santucci S., Valentini A. // 2009. IWASI 2009. 3rd International Workshop on Advances in sensors and Interfaces. - Trani, 25-26 June 2009. - P. 58-63. ↑

C572. Carrara S. New probe immobilizations by lipoate-diethalonamines or ethylene-glycol molecules for capacitance DNA chip. / Carrara S., Cavallini A., Leblebici Y., De Micheli G., Bhalla V., Valle F., Samori B., Benini L., Ricco B., Vikholm-Lundin I., Munter T. // 2009. IWASI 2009. 3rd International Workshop on Advances in sensors and Interfaces. - Trani, 25-26 June 2009. - P. 9-14. ↑

C573. Beaulieu D.R. Novel fast neutron counting technology for efficient detection of special nuclear materials. / Beaulieu D.R., Gorelikov D., Klotzsch H., de Rouffignac P., Saadatmand K., Stenton K., Sullivan N., Tremsin A.S. // 2009. HST '09. IEEE Conference on Technologies for Homeland Security. - Boston, MA, 11-12 May 2009. - P. 295-301. ↑

C574. Peng Wan-xi. Study on Leaching Mechanism of Micro/Nano Particles from *Cunninghamia lanceolata* Wood in NaOH Liquor. / Peng Wan-xi, Wu Yi-qiang, Zhang Zhong-feng, Qi Hong-chen, Zhang Ming-long. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-4. ↑

C575. Bing-Gang Ye. Principle and Realization of Nano-Molecular Probe in Molecular Imaging Technologies. / Bing-Gang Ye, You Ling. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-4. ↑

C576. Wang Zong-Liang. Research on Characterization and Biocompatibility of Bacterial Cellulose Tissue Engineering Scaffold. / Wang Zong-Liang, Jia Yuanyuan, Yi Shi, Cong Deng-Li, Chen Yan-Yan, Jia Shiru, Zhou Yu-Lai. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-5. ↑

C577. Wu Yi-qiang. Study on Purification Technique of Biological Chinese Herbal Medicine in Micro/Nano Particles of Chinese-fir Cells. / Wu Yi-qiang, Yuan Guang-ming, Peng Wan-xi, Li Song, Qiao Jian-zheng. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-3. ↑

C578. Deng-Guang Yu. Polyacrylonitrile/Kaolinite Hybrid Nanofiber Mats Aimed for Treatment of Polluted Water. / Deng-Guang Yu, Xiao-Fei Zhang, Xia-Xia Shen, Li-Min Zhu, Branford-White C., Yang Y.C., Welbeck E.D. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-3. ↑



- C579.** Kadir K.A. Energy efficient high speed CNFET based interconnect drivers for FPGAS. / Kadir K.A., Hasan M. // 2009. IMPACT '09. International Multimedia, Signal Processing and Communication Technologies. - Aligarh, 14-16 March 2009. - P. 48-51. ↑
- C580.** Dishun Zhao. Synthesis of Eco-Friendly Ionic Liquids by Microwave Irradiation and Their Applications in Michael Addition. / Dishun Zhao, Xiaolei Bao. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-4. ↑
- C581.** Belardini A. Non linear optical properties of nanostructured metallic surfaces. / Belardini A., Larciprete M.C., Centini M., Fazio E., Sibilia C., Bertolotti M., Toma A., Chiappe D., Boragno C., Buatier de Mongeot F. // 2009. ICTON 09. 11th International Conference on Transparent Optical Networks. - Azores, June 28 2009-July 2 2009. - P. 1. ↑
- C582.** Cenchao Shen. A Potential Useful Method for Calculating Relative Safety Index of Nanoparticles. / Cenchao Shen, Wenjuan Yang, Qingdai Liu, Maki H., Zhizhou Zhang. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-4. ↑
- C583.** Liu Dan-dan. Detection of Biocompatibility between Nano-Layered Double Hydroxides and Hela Cells. / Liu Dan-dan, Li Yan, Yang Xu. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-3. ↑
- C584.** Wu Yi-Qiang. Effect of KOH Extraction on Micro/Nano Particles of Wood Extractives and Hemicellulose Leaching from Chinese-fir Wood. / Wu Yi-Qiang, Peng Wan-Xi, Li Song, Qiao Jian-Zheng. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-3. ↑
- C585.** Kumari A. Magnetic Cellular Automata (MCA) arrays under spatially varying field. / Kumari A., Bhanja S. // 2009. NMDC '09. IEEE Nanotechnology Materials and Devices Conference. - Traverse City, MI, 2-5 June 2009. - P. 50-53. ↑
- C586.** Ming Mao Chu. Advances in selective etching for nano scale salicide fabrication. / Ming Mao Chu, Jung-Hua Chou. // 2009. NMDC '09. IEEE Nanotechnology Materials and Devices Conference. - Traverse City, MI, 2-5 June 2009. - P. 162-165. ↑
- C587.** Kayal H. A nano satellite constellation for detection of objects in earth orbit. 2009. RAST '09. 4th International Conference on Recent Advances in Space Technologies. - Istanbul, 11-13 June 2009. - P. 95-99. ↑
- C588.** Haifeng Yang. Electroluminescent organic light emitting micro/nanofibers fabricated using three-fluid coaxial electrospinning. / Haifeng Yang, Liang Dong. // 2009. NMDC '09. IEEE Nanotechnology Materials and Devices Conference. - Traverse City, MI, 2-5 June 2009. - P. 118-120. ↑
- C589.** Pulecio J.F. Magnetic Cellular Automata wires. / Pulecio J.F., Bhanja S. // 2009. NMDC '09. IEEE Nanotechnology Materials and Devices Conference. - Traverse City, MI, 2-5 June 2009. - P. 73-75. ↑
- C590.** King Wai Chiu Lai. Development of plasma integrated AFM nano manufacturing workcell. / King Wai Chiu Lai, Ning Xi, Jiangbo Zhang, Narendra J., Grotjohn T., Asmussen J. // 2009. NMDC '09. IEEE Nanotechnology Materials and Devices Conference. - Traverse City, MI, 2-5 June 2009. - P. 38-41. ↑
- C591.** Tahermaram M. Employing work function engineering and asymmetric gate oxide in nano-scale source-heterojunction-MOS-transistor. / Tahermaram M., Vadizadeh M., Eslamzadeh A., Fathipour M. // 2009. eit '09. IEEE International Conference on Electro/Information Technology. - Windsor, ON, 7-9 June 2009. - P. 196-201. ↑
- C592.** Jannesari R. Design and fabrication of si-based photonic crystal stamps. / Jannesari R., Bergmair I., Zamiri S., Hingerl K. // 2009. ICTON 09. 11th International Conference on Transparent Optical Networks. - Azores, June 28 2009-July 2 2009. - P. 1-4. ↑
- C593.** Zhang Jing. Ozonation Catalyzed by TiO<sub>2</sub>/Zeolite for Degradation of Nitrobenzene in Aqueous Solution. / Zhang Jing, Ma Jun, Liu Bai-Cang, Tang Li, Wang Shengjun, Yang Yi-Xin. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-4. ↑
- C594.** Joshi S. Wireless Sensor Network: Intricate modeling and analysis of CNT and MEMS based sensor



nodes. / Joshi S., Pathak R., Ahmed S. // 2009. IEDST '09. 2nd International Workshop on Electron Devices and Semiconductor Technology. - Mumbai, 1-2 June 2009. - P. 1-6. ↑

C595. Peng Wan-xi. Effect of Nano SiO<sub>2</sub> on Pyrolytic Reaction of Phenol-Formaldehyde Resin. / Peng Wan-xi, Wu Yi-qiang, Zhang Zhong-feng, Qi Hong-chen, Ma Qing-zhi. // 2009. ICBBE 2009. 3rd International Conference on Bioinformatics and Biomedical Engineering. - Beijing, 11-13 June 2009. - P. 1-3. ↑

C596. Jacob J. Surface plasmon polaritons in nano-waveguides with semiconductor guiding layer. / Jacob J., Babu A., Mathew G., Mathew V. // 2009. IEDST '09. 2nd International Workshop on Electron Devices and Semiconductor Technology. - Mumbai, 1-2 June 2009. - P. 1-4. ↑

C597. Shiching Ke. The research of electronic service applied to medical industry. / Shiching Ke, Chihhsung Shen. // 2009. ICEMI '09. 9th International Conference on Electronic Measurement & Instruments. - Beijing, 16-19 Aug. 2009. - P. 3-533-3-536-533. ↑

C598. Congyu Xu. Small-sized large travel nano-positioning system based on tubular permanent magnet synchronous linear motor. / Congyu Xu, Xiaofen Yu, Lingli Cheng. // 2009. ICEMI '09. 9th International Conference on Electronic Measurement & Instruments. - Beijing, 16-19 Aug. 2009. - P. 3-479-3-482-479. ↑

C599. Haipeng Liu. Measurements on mechanical properties of boron-doped silicon materials for micro inertia sensor. / Haipeng Liu, Shiqiao Gao, Shaohua Niu, Lei Jin. // 2009. ICEMI '09. 9th International Conference on Electronic Measurement & Instruments. - Beijing, 16-19 Aug. 2009. - P. 2-174-2-179-174. ↑

C600. Caswell G. Nanobond® assembly-a rapid, room temperature soldering process. 2009. EMPC 2009. European Microelectronics and Packaging Conference. - Rimini, 15-18 June 2009. - P. 1-6. ↑

C601. Zongliang Cao. Technology of single-material field-emission diode using polycrystalline diamond. / Zongliang Cao, Hatch S., Varney M., Aslam D. // 2009. IVNC 2009. 22nd International Vacuum Nanoelectronics Conference. - Shizuoka, 20-24 July 2009. - P. 281-282. ↑

C602. Manassis D. Advancements in bumping technologies for flip chip and WLCSP packaging. / Manassis D., Patzelt R., Ostmann A., Reichl H. // 2009. EMPC 2009. European Microelectronics and Packaging Conference. - Rimini, 15-18 June 2009. - P. 1-6. ↑

C603. Pfahl B. Closing technology knowledge gaps: Projects arising from the iNEMI technology roadmap. / Pfahl B., Arnold J., O'Malley G. // 2009. EMPC 2009. European Microelectronics and Packaging Conference. - Rimini, 15-18 June 2009. - P. 1-5. ↑

C604. Filiol H. Piecewise-polynomial modeling for analog circuit performance metrics. / Filiol H., O'Connor I., Morche D. // 2009. ECCTD 2009. European Conference on Circuit Theory and Design. - Antalya, 23-27 Aug. 2009. - P. 237-240. ↑

C605. Sheng-Ping Yong. Variability-Tolerant Binary Content Addressable Memory Cells. / Sheng-Ping Yong, Jin-Fu Li, Yu-Jen Huang. // 2009. MTDT '09. IEEE International Workshop on Memory Technology, Design, and Testing. - Hsinchu, Aug. 31 2009-Sept. 2 2009. - P. 44-49. ↑

C606. Jong-won You. Design of a low-vibration micro-stepping controller for dom-camera. / Jong-won You, Jung-han Kim. // 2009. ICMA 2009. International Conference on Mechatronics and Automation. - Changchun, 9-12 Aug. 2009. - P. 296-301. ↑

C607. Daeinabi K. Principles of nano-robotics based on atomic force microscopy. / Daeinabi K., Teshnehlab M. // 2009. ICMA 2009. International Conference on Mechatronics and Automation. - Changchun, 9-12 Aug. 2009. - P. 1589-1595. ↑

C608. Qin Yu. Transmission characteristics study of memristors based Op-Amp circuits. / Qin Yu, Zhiguang Qin, Juebang Yu, Yuming Mao. // 2009. ICCAS 2009. International Conference on Communications, Circuits and Systems. - Milpitas, CA, 23-25 July 2009. - P. 974-977. ↑

C609. Nguyen Vh. Fabrication of bottom die substrate solderless interconnection based on nano copper wires. / Nguyen Vh., Castelan P., Khatir Z., Lebey T., Bley V., Sewraj N., Luan Qh., Schlegel B. // 2009. EPE '09. 13th European Conference on Power Electronics and Applications. - Barcelona, 8-10 Sept. 2009. - P. 1-9. ↑



- C610.** Yu Chen. Pulsed vacuum flashover properties of micro and nano Al<sub>2</sub>O<sub>3</sub>-3H<sub>2</sub>O/epoxy composites. / Yu Chen, Yonghong Cheng, Jiabin Zhou, Zengbin Wang, Guodong Meng, Kai Wu. // 2009. ICPADM 2009. IEEE 9th International Conference on the Properties and Applications of Dielectric Materials. - Harbin, 19-23 July 2009. - P. 785-788. ↑
- C611.** Junguo Gao. Effect of compound technology on polyethylene/ montmorillonite composites. / Junguo Gao, Ning Guo, Yali Liu, Jing Li, Haitao Hu, Liang Sun, Xiaohong Zhang. // 2009. ICPADM 2009. IEEE 9th International Conference on the Properties and Applications of Dielectric Materials. - Harbin, 19-23 July 2009. - P. 781-784. ↑
- C612.** Di Lu. Study of the synthesis of WO<sub>3</sub> nano-structured arrays by tungsten hot filament chemical vapor deposition method and their field emission properties. / Di Lu, Bo Liang, Ogino A., Nagatsu M. // 2009. IVNC 2009. 22nd International Vacuum Nanoelectronics Conference. - Shizuoka, 20-24 July 2009. - P. 237-238. ↑
- C613.** Tai F. Effects of service parameters on thermomechanical fatigue behaviors of new nano composite solder joints. / Tai F., Guo F., Liu B., Xia Z.D., Shi Y.W. // 2009. ICEPT-HDP '09. International Conference on Electronic Packaging Technology & High Density Packaging. - Beijing, 10-13 Aug. 2009. - P. 753-758. ↑
- C614.** Tao Hang. Super-hydrophobic nickel films with micro-nano hierarchical structure prepared by electrodeposition for appliance industry. / Tao Hang, Ming Li, Anmin Hu, Dali Mao. // 2009. ICEPT-HDP '09. International Conference on Electronic Packaging Technology & High Density Packaging. - Beijing, 10-13 Aug. 2009. - P. 684-686. ↑
- C615.** Nadia A. The fabrication of composite solder by addition of copper nano powder into Sn-3.5Ag solder. 2009. ICEPT-HDP '09. International Conference on Electronic Packaging Technology & High Density Packaging. - Beijing, 10-13 Aug. 2009. - P. 607-610. ↑
- C616.** Zhongxian Zhang. Electrically conductive adhesives with sintered silver nanowires. / Zhongxian Zhang, Xiangyan Chen, Haowei Yang, Huiying Fu, Fei Xiao. // 2009. ICEPT-HDP '09. International Conference on Electronic Packaging Technology & High Density Packaging. - Beijing, 10-13 Aug. 2009. - P. 834-837. ↑
- C617.** Suibin Luo. Synthesis and characterization of Nano BaTiO<sub>3</sub>/epoxy composites for embedded capacitors. / Suibin Luo, Rong Sun, Jingwei Zhang, Shuhui Yu, Ruxu Du, Zhijun Zhang. // 2009. ICEPT-HDP '09. International Conference on Electronic Packaging Technology & High Density Packaging. - Beijing, 10-13 Aug. 2009. - P. 856-859. ↑
- C618.** Rashid M.A. Windmills & CSFs for ERP-diffusion of technovation in academia-industry: A qualitative analysis. / Rashid M.A., Nas Z., Shami M.-u.-D., Muhmood U., Gul N., Oklu C. // 2009. PICMET 2009. Portland International Conference on Management of Engineering & Technology. - Portland, OR, 2-6 Aug. 2009. - P. 2711-2721. ↑
- C619.** Zhongwen Pan. Electroless plating of copper nano-coned array for high reliability packaging. / Zhongwen Pan, Anmin Hu, Tao Hang, Yingying Duan, Ming Li, Dali Mao. // 2009. ICEPT-HDP '09. International Conference on Electronic Packaging Technology & High Density Packaging. - Beijing, 10-13 Aug. 2009. - P. 867-871. ↑
- C620.** Chuang-Chun Chiou. A Modified FTA-FMEA Methodology: An Application for CNT-BLU of TFT-LCD. / Chuang-Chun Chiou, Jenteng Tsai, Yung-Sheng Fang. // 2009. NISS '09. International Conference on New Trends in Information and Service Science. - Beijing, June 30 2009-July 2 2009. - P. 250-255. ↑
- C621.** Ishida T. In-situ TEM observation and electrical measurement of gold nanocontact during tensile test using MEMS opposing tips. / Ishida T., Kakushima K., Fujita H. // 2009. IVNC 2009. 22nd International Vacuum Nanoelectronics Conference. - Shizuoka, 20-24 July 2009. - P. 169-170. ↑
- C622.** Han G. Nano-sized hexagonal platelet-like ZnO for the nano-phosphor application. / Han G., Shibukawa A., Okada M., Neo Y., Aoki T., Mimura H. // 2009. IVNC 2009. 22nd International Vacuum Nanoelectronics Conference. - Shizuoka, 20-24 July 2009. - P. 191-192. ↑
- C623.** Pan J.Y. Enhanced field emission properties from two-step screen-printed carbon nano-tube film. / Pan J.Y., Yuan Xie, Gao Y.L., Zhu C.C. // 2009. IVNC 2009. 22nd International Vacuum Nanoelectronics Conference. - Shizuoka, 20-24 July 2009. - P. 259-260. ↑



- C624.** Kumari A. CNT logic knowledge module integrated in digital CMOS logic design course. / Kumari A., Bhanja S. // 2009. MSE '09. IEEE International Conference on Microelectronic Systems Education. - San Francisco, CA, 25-27 July 2009. - P. 115-117. ↑
- C625.** Wei Zhang. Nano resonator simulation fabrication and packaging consideration. / Wei Zhang, Zewen Liu, Zheng Wang. // 2009. ICEPT-HDP '09. International Conference on Electronic Packaging Technology & High Density Packaging. - Beijing, 10-13 Aug. 2009. - P. 508-511. ↑
- C626.** Sommer J.-P. Advanced package design for electronic and MEMS applications supported by fe analyses and deformation measurements. / Sommer J.-P., Michel B., Kugler A., Rank H. // 2009. ICEPT-HDP '09. International Conference on Electronic Packaging Technology & High Density Packaging. - Beijing, 10-13 Aug. 2009. - P. 193-197. ↑
- C627.** Jihua Wang. Effects of inorganic components on aggregate structure of the PI/SiO<sub>2</sub> hybrid film. / Jihua Wang, Mingyan Zhang, Feng Tian, Zijian Wu. // 2009. ICPADM 2009. IEEE 9th International Conference on the Properties and Applications of Dielectric Materials. - Harbin, 19-23 July 2009. - P. 872-874. ↑
- C628.** Ming Liu. FPGA based on integration of carbon nanorelays and CMOS devices. / Ming Liu, Haigang Yang, Tanachutiwat S., Wei Wang. // 2009. NANOARCH '09. IEEE/ACM International Symposium on Nanoscale Architectures. - San Francisco, CA, 30-31 July 2009. - P. 61-64. ↑
- C629.** Farazmand N. Online detection of multiple faults in crossbar nano-architectures using dual rail implementations. / Farazmand N., Tahoori M.B. // 2009. NANOARCH '09. IEEE/ACM International Symposium on Nanoscale Architectures. - San Francisco, CA, 30-31 July 2009. - P. 79-82. ↑
- C630.** Olmon R.L. Optical antennas for vector near-field imaging. / Olmon R.L., Saraf L., Krenz P.M., Boreman G., Raschke M. // 2009 and 2009 Conference on Quantum electronics and Laser Science Conference. CLEO/QELS 2009. Conference on Lasers and Electro-Optics. - Baltimore, MD, 2-4 June 2009. - P. 1-2. ↑
- C631.** Dingier A. System-level energy and performance projections for nanomagnet-based logic. / Dingier A., Garrison M., Hu X.S., Niemier M., Alam M.T. // 2009. NANOARCH '09. IEEE/ACM International Symposium on Nanoscale Architectures. - San Francisco, CA, 30-31 July 2009. - P. 21-26. ↑
- C632.** Hemawan K.W. Microwave plasma-assisted diamond synthesis reactor design for large deposition areas at high rates. / Hemawan K.W., Gu Y., Lu J., Grotjohn T.A., Asmussen J. // 2009. ICOPS 2009. IEEE International Conference on Plasma Science-Abstracts. - San Diego, CA, 1-5 June 2009. - P. 1. ↑
- C633.** Liu T.M. Micro/nano-particle electrostatic accelerator for electric propulsion. / Liu T.M., Gallimore A.D., Gilchrist B.E., Peterson P.Y. // 2009. ICOPS 2009. IEEE International Conference on Plasma Science-Abstracts. - San Diego, CA, 1-5 June 2009. - P. 1. ↑
- C634.** Borkar S. Design perspectives on 22nm CMOS and beyond. 2009. DAC '09. 46th ACM/IEEE Design Automation Conference. - San Francisco, CA, 26-31 July 2009. - P. 93-94. ↑
- C635.** Pathak R. Implementation of parallelization and nano simulation using multi-scale modeling on various HPC setups. / Pathak R., Joshi S. // 2009. CITISIA 2009 Innovative Technologies in Intelligent Systems and Industrial Applications. - Monash, 25-26 July 2009. - P. 249-254. ↑
- C636.** Book-Sung Park. A novel micro-structure internal antenna with sputter-deposited for wireless communication applications. / Book-Sung Park, Jee-Myun Lee, Seon-Gu Lee, Sung-Ho Lee, Jin-Man Jang, Chul-Ju Kim. // 2009. ISIE 2009. IEEE International Symposium on Industrial Electronics. - Seoul, 5-8 July 2009. - P. 195-199. ↑
- C637.** Chen R.T. Silicon nano- and micro-photonic devices. / Chen R.T., Subbaraman H. // 2009. OECC 2009. 14th OptoElectronics and Communications Conference. - Hong Kong, 13-17 July 2009. - P. 1-2. ↑
- C638.** Wissenwasser J. Silicone-based encapsulation of a cell culture measurement device under physiological conditions. / Wissenwasser J., Vellekoop M., Nicolics J. // 2009. ISSE 2009. 32nd International Spring Seminar on Electronics Technology. - Brno, 13-17 May 2009. - P. 1-6. ↑
- C639.** Pathak R. Reliability modeling and optimization of MEMS elements in various devices using multi-scale concepts. / Pathak R., Joshi S. // 2009. CITISIA 2009 Innovative Technologies in Intelligent Systems and



Industrial Applications. - Monash, 25-26 July 2009. - P. 332-337. ↑

C640. Pathak R. Modeling Nano enabled elements of solar and fuel cell. / Pathak R., Joshi S., Kotak P., Ahmed S., Verma V. // 2009. CITISIA 2009 Innovative Technologies in Intelligent Systems and Industrial Applications. - Monash, 25-26 July 2009. - P. 281-286. ↑

C641. Pathak R. Intricate modeling of HDD and reliability analysis in light of advances in Nanotechnology and MEMS. / Pathak R., Ahmed S., Joshi S. // 2009. CITISIA 2009 Innovative Technologies in Intelligent Systems and Industrial Applications. - Monash, 25-26 July 2009. - P. 275-280. ↑

C642. Pathak R. Multi Scale modeling and intricate study of MEMS based elements in RFID systems. / Pathak R., Joshi S., Kotak P. // 2009. CITISIA 2009 Innovative Technologies in Intelligent Systems and Industrial Applications. - Monash, 25-26 July 2009. - P. 293-298. ↑

C643. Jia-Yush Yen. Hybrid servo design for large area nano pattern stitching. / Jia-Yush Yen, Cheng-Hung Chen, Lien-Sheng Chen, Kuen-Yu Tsai, Shuo-Hung Chang. // 2009. AIM 2009. IEEE/ASME International Conference on Advanced Intelligent Mechatronics. - Singapore, 14-17 July 2009. - P. 1572-1576. ↑

C644. Sullivan C.R. Integrating magnetics for on-chip power: Challenges and opportunities. 2009. CICC '09. IEEE Custom Integrated Circuits Conference. - San Jose, CA, 13-16 Sept. 2009. - P. 291-298. ↑

C645. Tejada A. Towards automatic control of scanning transmission electron microscopes. / Tejada A., van der Hoeven S.W., den Dekker A.J., Van den Hof P.M.J. // 2009 IEEE Control Applications, (CCA) & Intelligent Control, (ISIC). - Saint Petersburg, 8-10 July 2009. - P. 788-793. ↑

C646. Saxena V. A K-Delta-1-Sigma modulator for wideband analog to digital conversion. / Saxena V., Kaijun Li, Geng Zheng, Baker R.J. // 2009. MWSCAS '09. 52nd IEEE International Midwest Symposium on Circuits and Systems. - Cancun, 2-5 Aug. 2009. - P. 411-414. ↑

C647. Tummala R.R. Trend from ICs to 3D ICs to 3D systems. / Tummala R.R., Sundaram V., Chatterjee R., Raj P.M., Kumbhat N., Sukumaran V., Sridharan V., Choudury A., Qiao Chen, Bandyopadhyay T. // 2009. CICC '09. IEEE Custom Integrated Circuits Conference. - San Jose, CA, 13-16 Sept. 2009. - P. 439-444. ↑

C648. Li Wei. Development of microfluidic chips based on magnetic nano-materials in biomedical applications. / Li Wei, Mao Chun-mei, Yu Jin-hui, Sun Zuo-jun. // 2009. ITIME '09. IEEE International Symposium on IT in Medicine & Education. - Jinan, 14-16 Aug. 2009. - Vol. 1. - P. 1150-1153. ↑

C649. Saxena V. Indirect compensation techniques for three-stage CMOS op-amps. / Saxena V., Baker R.J. // 2009. MWSCAS '09. 52nd IEEE International Midwest Symposium on Circuits and Systems. - Cancun, 2-5 Aug. 2009. - P. 9-12. ↑

C650. Balachandran G.K. A high dynamic range ASK demodulator for passive UHF RFID with automatic over-voltage protection and detection threshold adjustment. / Balachandran G.K., Barnett R.E. // 2009. CICC '09. IEEE Custom Integrated Circuits Conference. - San Jose, CA, 13-16 Sept. 2009. - P. 383-386. ↑

C651. Vorobyev A.Y. Femtosecond laser blackening of metals. / Vorobyev A.Y., Chunlei Guo. // 2009. MWSCAS '09. 52nd IEEE International Midwest Symposium on Circuits and Systems. - Cancun, 2-5 Aug. 2009. - P. 905-908. ↑

C652. Qin T. Crystal defects analysis using nano-probe technologies. / Qin T., Ming Zhang, Gong E., Guo A., Qiang Guo, Chien W.-T.K. // 2009. IPFA 2009. 16th IEEE International Symposium on the Physical and Failure Analysis of Integrated Circuits. - Suzhou, Jiangsu, 6-10 July 2009. - P. 286-289. ↑

C653. Peng Wan-xi. Study on Dissolving Rules of Nano Particles from E. camaldulensis Wood Flour. / Peng Wan-xi, Qi Hong-chen, Wu Yi-qiang, Zhang Zhong-feng, Zhang Dang-quan. // 2009. SOPO 2009. Symposium on Photonics and Optoelectronics. - Wuhan, 14-16 Aug. 2009. - P. 1-4. ↑

C654. Huang J.C. A runout measurement technology with nanometer resolution for applications in hard disk drives. / Huang J.C., Bi C. // 2009. AIM 2009. IEEE/ASME International Conference on Advanced Intelligent Mechatronics. - Singapore, 14-17 July 2009. - P. 528-531. ↑

C655. Muruganandam K. Implementation of WAP gateway technologies through wireless communication. /



Muruganandam K., Chandra C.H.K. // 2009. ICCSIT 2009. 2nd IEEE International Conference on Computer Science and Information Technology. - Beijing, 8-11 Aug. 2009. - P. 342-345. ↑

C656. {no data available}. ICCCN 2009 Conference Program. 2009. ICCCN 2009. Proceedings of 18th International Conference on Computer Communications and Networks. - San Francisco, CA, 3-6 Aug. 2009. - P. i-xv. ↑

C657. Yang Liu. Nano-Scale On-Chip Irregular Network Analysis. / Yang Liu, Lebeck A.R. // 2009. ICCCN 2009. Proceedings of 18th International Conference on Computer Communications and Networks. - San Francisco, CA, 3-6 Aug. 2009. - P. 1-5. ↑

C658. Sepulveda J. Learning microelectronics through technology and research. / Sepulveda J., Servidio R., Gabriele L., Ali G. // 2009. ICCSIT 2009. 2nd IEEE International Conference on Computer Science and Information Technology. - Beijing, 8-11 Aug. 2009. - P. 122-126. ↑

C659. Cunningham J.E. Communication in macrochips using silicon photonics for high-performance and low-energy computing. / Cunningham J.E., Krishnamoorthy A.V., Xuezhe Zheng, Guoliang Li, Ron Ho, Lexau J., Shubin I., Raj K. // 2009. VLSI-DAT '09. International Symposium on VLSI Design, Automation and Test. - Hsinchu, 28-30 April 2009. - P. 35. ↑

C660. Goel S. Modeling of Selective Carbon Nanotubes Growth for Non-classical Memory Applications. / Goel S., Masunov A.E. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 162-166. ↑

C661. Conedera V. Fabrication of Activated Carbon Electrodes by Inkjet Deposition. / Conedera V., Mesnilgrente F., Brunet M., Fabre N. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 157-161. ↑

C662. Hamdi A. Leaky Coplanar Waveguide Antenna with Tunable Beamwidth and Radiation Angle Using Composite Right/Left-Handed Materials. / Hamdi A., Kouki A.B., Samet A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 152-156. ↑

C663. {no data available}. Author Index. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, Mexico, 1-7 Feb. 2009. - P. 167-168. ↑

C664. Zareie H. RCS of circular carbon NANO tube antenna array. / Zareie H., Davoudzadeh N., Tafazoli M., Fard G., Hasan M., Shamsoddin. // 2009. ANTEM/URSI 2009. 13th International Symposium on Antenna Technology and Applied Electromagnetics and the Canadian Radio Science Meeting. - Banff, AB, 15-18 Feb. 2009. - P. 1-4. ↑

C665. Kowalski L. Sensitivity analysis of the chip for REMS wind sensor. / Kowalski L., Ricart J., Jimenez V., Dominguez M., Castaer L. // 2009. CDE 2009. Spanish Conference on Electron Devices. - Santiago de Compostela, 11-13 Feb. 2009. - P. 289-292. ↑

C666. {no data available}. Publisher's Information. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, Mexico, 1-7 Feb. 2009. - P. 170. ↑

C667. Jankowska E. Emission of Nanosize Particles in the Process of Nanoclay Blending. / Jankowska E., Zatorski W. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 147-151. ↑

C668. Popa C. Superior-Order Curvature-Corrected Logarithmic CMOS Nanostructure. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 130-133. ↑

C669. Ovchinnikov V. Large-Area Arrays of Pillar-Based Metal Nanostructures. / Ovchinnikov V., Shevchenko A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 125-129. ↑

C670. Casares A. CrossBeam, Principles and Application. / Casares A., Gnauck P. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 122-124. ↑

↑



- C671.** Vazquez M. Low-Field Microwave Phenomena in CoFeSiB Amorphous Magnetic Microwires. / Vazquez M., Badidni-Confalonieri G., Torrejon J., Valenzuela R., Montiel H., Alvarez G. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 134-137. ↑
- C672.** Debnath G. Design for Manufacturability and Reliability in Nano Era. / Debnath G., Thadikaran P. // 2009 22nd International Conference on VLSI Design. - New Delhi, 5-9 Jan. 2009. - P. 33-34. ↑
- C673.** Halaciuga I. Synthesis of Silver Colloids: Experiment and Computational Model. / Halaciuga I., Robb D.T., Privman V., Goia D.V. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 141-146. ↑
- C674.** Cristea L. The Study of the Crystalline Structure of the Phases in the Al-Ni Alloys Ultra Rapid Solidification. / Cristea L., Cristea E. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 138-140. ↑
- C675.** Ziolkowski R.W. Metamaterial-inspired engineering of antenna systems. 2009. ANTEM/URSI 2009. 13th International Symposium on Antenna Technology and Applied Electromagnetics and the Canadian Radio Science Meeting. - Toronto, ON, 15-18 Feb. 2009. - P. 1. ↑
- C676.** Nauenheim C. Phenomenological considerations of resistively switching TiO<sub>2</sub> in nano crossbar arrays. / Nauenheim C., Kugeler C., Trelenkamp S., Rudiger A., Waser R. // 2009. ULIS 2009. 10th International Conference on Ultimate Integration of Silicon. - Aachen, 18-20 March 2009. - P. 135-138. ↑
- C677.** Shibata T. Implementing brain-like systems using nano functional devices. 2009. ULIS 2009. 10th International Conference on Ultimate Integration of Silicon. - Aachen, 18-20 March 2009. - P. 131-134. ↑
- C678.** Meredith K. New MEMS technologies for integrated vehicle health management and fluid sensing applications. / Meredith K., Safai M., Georgeson G. // 2009 IEEE Aerospace conference. - Big Sky, MT, 7-14 March 2009. - P. 1-6. ↑
- C679.** Nakajima Y. Discussion of origins of high-density trap states in SIMOX wafers. / Nakajima Y., Toda T., Hanajiri T., Toyabe T., Sugano T. // 2009. ULIS 2009. 10th International Conference on Ultimate Integration of Silicon. - Aachen, 18-20 March 2009. - P. 185-188. ↑
- C680.** Moradinasab M. Stable, low power and high performance SRAM based on CNFET. / Moradinasab M., Fathipour M. // 2009. ULIS 2009. 10th International Conference on Ultimate Integration of Silicon. - Aachen, 18-20 March 2009. - P. 317-320. ↑
- C681.** Yoshii K. A nano-functional-device-based image feature extraction circuitry with current-balancing feedback. / Yoshii K., Shibata T. // 2009. ULIS 2009. 10th International Conference on Ultimate Integration of Silicon. - Aachen, 18-20 March 2009. - P. 233-236. ↑
- C682.** Trong Tu Bui. A scalable architecture of associative processors employing nano functional devices. / Trong Tu Bui, Shibata T. // 2009. ULIS 2009. 10th International Conference on Ultimate Integration of Silicon. - Aachen, 18-20 March 2009. - P. 213-216. ↑
- C683.** Bhavaraju K.C. Interactive Virtual Reality Simulation for Nanoparticle Manipulation and Nanoassembly using Optical Tweezers. 2009. VR 2009. IEEE Virtual Reality Conference. - Lafayette, LA, 14-18 March 2009. - P. 251-252. ↑
- C684.** Ando T. Degradation of Mechanical Strength at Si/SiO<sub>2</sub> Interface on SOI Wafers under Cyclic Loading. / Ando T., Takumi T., Sato K. // 2009. MEMS 2009. IEEE 22nd International Conference on Micro Electro Mechanical Systems. - Sorrento, 25-29 Jan. 2009. - P. 665-668. ↑
- C685.** Yongliang Yang. Giant Piezoresistance of Nano-Thick Silicon Induced by Interface Electron Trapping Effect. / Yongliang Yang, Xinxin Li. // 2009. MEMS 2009. IEEE 22nd International Conference on Micro Electro Mechanical Systems. - Sorrento, 25-29 Jan. 2009. - P. 555-558. ↑
- C686.** Samukawa S. Damage-Free Plasma Etching Processes for Future Nanoscale Devices. 2009. MEMS 2009. IEEE 22nd International Conference on Micro Electro Mechanical Systems. - Sorrento, 25-29 Jan. 2009. - P. 112-119. ↑



- C687.** Abrahantes M. Implementation and control of a reconfigurable 4-tetrahedral robot. / Abrahantes M., Doorn P., Richard J., Barbachyn S. // 2009. SSST 2009. 41st Southeastern Symposium on System Theory. - Tullahoma, TN, 15-17 March 2009. - P. 344-349. ↑
- C688.** Mohanty S.P. A universal level converter towards the realization of energy efficient implantable drug delivery Nano-Electro-Mechanical-Systems. / Mohanty S.P., Ghai D., Kougianos E., Joshi B. // 2009. ISQED 2009. Quality Electronic Design Quality of Electronic Design. - San Jose, CA, 16-18 March 2009. - P. 673-679. ↑
- C689.** Ghai D. Variability-aware optimization of nano-CMOS Active Pixel Sensors using design and analysis of Monte Carlo experiments. / Ghai D., Mohanty S.P., Kougianos E. // 2009. ISQED 2009. Quality Electronic Design Quality of Electronic Design. - San Jose, CA, 16-18 March 2009. - P. 172-178. ↑
- C690.** Ghai D. A PVT aware accurate statistical logic library for high- $\kappa$  metal-gate nano-CMOS. / Ghai D., Mohanty S.P., Kougianos E., Patra P. // 2009. ISQED 2009. Quality Electronic Design Quality of Electronic Design. - San Jose, CA, 16-18 March 2009. - P. 47-54. ↑
- C691.** Sarvepalli P.K. Encoding Subsystem Codes with and without Noisy Gauge Qubits. / Sarvepalli P.K., Klappenecker A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 48-53. ↑
- C692.** Gualdi G. Spin-Chains as Quantum Channels for Qubit-State Transfer. / Gualdi G., Marzoli I., Tombesi P. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 42-47. ↑
- C693.** Pirandola S. Eavesdropping of Two-Way Coherent-State Quantum Cryptography via Gaussian Quantum Cloning Machines. / Pirandola S., Mancini S., Lloyd S., Braunstein S.L. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 38-41. ↑
- C694.** Brida G. On/off Detection Method for Reconstructing the Statistics of Quantum Optical States: An Overview. / Brida G., Genovese M., Gramegna M., Piacentini F., Olivares S., Paris M.G.A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 54-58. ↑
- C695.** Wen-Ran Zhang. Six Conjectures in Quantum Physics and Computational Neuroscience. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 67-72. ↑
- C696.** Avis D. The Quantum Locker Puzzle. / Avis D., Broadbent A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 63-66. ↑
- C697.** Broadbent A. The GHZ State in Secret Sharing and Entanglement Simulation. / Broadbent A., Chouha P.-R., Tapp A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 59-62. ↑
- C698.** Blier H. All Languages in NP Have Very Short Quantum Proofs. / Blier H., Tapp A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 34-37. ↑
- C699.** Vardi A. Quantum-Zeno Control of Collisional Entanglement in a Bose-Josephson Junction. / Vardi A., Khodorkovsky Y., Kurizki G. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 5-10. ↑
- C700.** Marchildon L. Does Quantum Mechanics Need Interpretation?. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 11-16. ↑
- C701.** Cabello A. Experimentally Testable State-Independent Violation of Bell-Type Inequalities for Quantum Contextuality. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 17-19. ↑
- C702.** Brida G. Spectral Characterisation of Spontaneous Parametric-Down Conversion Entangled Photons Source in Femtosecond Pulsed Regime. / Brida G., Caricato V., Genovese M., Gramegna M., Kulik S.P., Fedorov M.V., Krivitsky L.A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro



Technologies. - Cancun, 1-7 Feb. 2009. - P. 1-4. ↑

**C703.** Hirata Y. An Efficient Method to Convert Arbitrary Quantum Circuits to Ones on a Linear Nearest Neighbor Architecture. / Hirata Y., Nakanishi M., Yamashita S., Nakashima Y. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 26-33. ↑

**C704.** Rass S. Game-Theoretic Security Analysis of Quantum Networks. / Rass S., Schartner P. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 20-25. ↑

**C705.** {no data available}. Preface. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, Mexico, 1-7 Feb. 2009. - P. viii. ↑

**C706.** Prevenslik T.V. Heat Transfer in Thin Films. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 73-76. ↑

**C707.** Lingasubramanian K. An Error Model to Study the Behavior of Transient Errors in Sequential Circuits. / Lingasubramanian K., Bhanja S. // 2009 22nd International Conference on VLSI Design. - New Delhi, 5-9 Jan. 2009. - P. 485-490. ↑

**C708.** Yacob A.R. Nano Tungsten Carbide Supported on Carbon from Palm Kernel Shell in Remediation of Chlorofluorocarbon (CFC12). / Yacob A.R., Hanapi S.Z., Inderan V. // 2009. ICCET '09. International Conference on Computer Engineering and Technology. - Singapore, 22-24 Jan. 2009. - Vol. 2. - P. 556-563. ↑

**C709.** Belotti M. All optical switching in silicon-on-insulator photonic wire nano-cavities. / Belotti M., Galli M., Gerace D., Andreani L.C., Zain A.R.M., Johnson N.P., Sorel M., De La Rue R.M. // 2009 IEEE/LEOS Winter Topicals Meeting Series. - Innsbruck, 12-14 Jan. 2009. - P. 30-31. ↑

**C710.** Brassard G. Oblivious Transfer a la Merkle. / Brassard G., Salvail L., Tapp A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 102-108. ↑

**C711.** Singh J. Single Ended Static Random Access Memory for Low-Vdd, High-Speed Embedded Systems. / Singh J., Mathew J., Mohanty S.P., Pradhan D.K. // 2009 22nd International Conference on VLSI Design. - New Delhi, 5-9 Jan. 2009. - P. 307-312. ↑

**C712.** Rigatos G.G. Open-Loop Control of Particle Systems Based on a Model of Coupled Stochastic Oscillators. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 115-121. ↑

**C713.** Lessiak K. Statistical Analysis of QKD Networks in Real-Life Environments. / Lessiak K., Kollmitzer C., Schauer S., Pilz J., Rass S. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 109-114. ↑

**C714.** {no data available}. Title Page i. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. i. ↑

**C715.** Mokkapati V. Fabrication and Testing of a TMMF S2030 Based Micro Fluidic Device for Single Cell Analysis. / Mokkapati V., Zhang L., Hanfoug R., Mollinger J., Bastemeijer J., Bossche A. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 86-89. ↑

**C716.** Watson B. Micromotor of Less Than 1 mm<sup>3</sup> Volume for In Vivo Medical Procedures. / Watson B., Friend J., Yeo L. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 81-85. ↑

**C717.** Lebrun S. Efficient Frequency Converters Based on Stimulated Raman Scattering in Hollow Core Photonic Crystal Fibres Filled with Nonlinear Liquids. / Lebrun S., Delaye P., Frey R., Roosen G. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 77-80. ↑

**C718.** Rass S. Adaptive Error Correction with Dynamic Initial Block Size in Quantum Cryptographic Key Distribution Protocols. / Rass S., Kollmitzer C. // 2009. ICQNM '09. Third International Conference on Quantum,



Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 90-95. ↑

C719. {no data available}. Title Page iii. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, Mexico, 1-7 Feb. 2009. - P. iii. ↑

C720. {no data available}. Copyright Page. 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, Mexico, 1-7 Feb. 2009. - P. iv. ↑

C721. Pivk M. SSL/TLS with Quantum Cryptography. / Pivk M., Kollmitzer C., Rass S. // 2009. ICQNM '09. Third International Conference on Quantum, Nano and Micro Technologies. - Cancun, 1-7 Feb. 2009. - P. 96-101. ↑

C722. Hildreth O. Wet chemical method to etch sophisticated nanostructures into silicon wafers using sub-25nm feature sizes and high aspect ratios. / Hildreth O., Yonghao Xiu, Wong C.P. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 860-864. ↑

C723. Myongjai Lee. Packaging and interconnect technologies for the development of GaN nanowire-based light emitting diodes. / Myongjai Lee, Jen-Hau Cheng, Lee Y.C., Seghete D., George S.M., Schlager J.B., Bertness K., Sanford N.A. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 843-847. ↑

C724. Das R.N. "Green" nanocomposites for electronic packaging. / Das R.N., Papathomas K.I., Poliks M.D., Markovich V.R. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 793-800. ↑

C725. Trang Thai. Characterization and testing of novel polarized nanomaterial textiles for ultrasensitive wireless gas sensors. / Trang Thai, Ratner J., Wenhua Chen, DeJean G., Tentzeris M.M. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 1049-1052. ↑

C726. Kumbhat N. Highly-reliable, 30µm pitch copper interconnects using nano-ACF/NCF. / Kumbhat N., Choudhury A., Raine M., Mehrotra G., Raj P.M., Zhang R., Moon K.S., Chatterjee R., Sundaram V., Meyer-Berg G., Wong C.P., Tummala R.R. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 1479-1485. ↑

C727. Stam F. Micro-nano interconnect between gold bond pads and copper nano-wires embedded in a polymer template. / Stam F., Razeeb K.M., Salwa S., Mathewson A. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 1470-1474. ↑

C728. Jiantao Zheng. Non-contact magnetic actuation test technique to characterize interfacial fatigue fracture of thin films. / Jiantao Zheng, Ostrowicki G., Sitaraman S.K. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 1368-1373. ↑

C729. Topper M. BCB with nano-filled BaSrTiO<sub>3</sub> for thin film capacitors. / Topper M., Fischer T., Zang M., Teipel U., Fehrenbacher U., Reichl H. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 784-792. ↑

C730. Xu J.S. Engineering nano interfacial layers for low contact resistance in chip to package interconnects. / Xu J.S., Ramanathan L., Cruau D., Chen J., Wentao Qin, Beugin V., Wei Liu, Mitchell D. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 46-53. ↑

C731. Xiaomin Jin. Design Simulation of Top ITO Gratings to Improve Light Transmission for Gallium Nitride LEDs. / Xiaomin Jin, Trieu S., Fei Wang, Bei Zhang, Tao Dai, Xiangning Kang, Guoyi Zhang. // 2009. ITNG '09. Sixth International Conference on Information Technology: New Generations. - Las Vegas, NV, 27-29 April 2009. - P. 1-4. ↑

C732. Labunov V.A. Nanostructuring technologies for reliable moveable elements. / Labunov V.A., Timoshkov Yu.V., Kurmashev V.I., Timoshkov V.Yu., Sakova A.A. // 2009. MEMSTECH 2009. 2009 5th International Conference on Perspective Technologies and Methods in MEMS Design. - Zakarpattya, 22-24 April 2009. - P. 50-52. ↑

C733. Das R.N. Influence of carbon, metal-coated polymer, and nano powders on sintering and electrical performance of nano-micro-filled conducting adhesives for z-axis interconnections. / Das R.N., Egitto F.D.,



Lauffer J.M., Poliks M.D., Markovich V.R. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 180-187. ↑

C734. Qizhen Liang. Thermal conductivity of epoxy/surface functionalized carbon nano materials. / Qizhen Liang, Wei Wang, Kyoung-Sik Moon, Wong C.P. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 460-464. ↑

C735. Celik E. Mechanical characterization of ultra-thin films by combining AFM nanoindentation tests and peridynamic simulations. / Celik E., Oterkus E., Guven I., Madenci E. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 262-268. ↑

C736. Suhir E. Lateral compliance and elastic stability of a dual-coated optical fiber of finite length, with application to nano-rods embedded into low-modulus elastic media. 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 213-219. ↑

C737. Gurrum S.P. A coaxial probe system for measuring Z-direction electrical resistivity of conductive polymers. / Gurrum S.P., Dunne R., Lamson M. // 2009. ECTC 2009. 59th Electronic Components and Technology Conference. - San Diego, CA, 26-29 May 2009. - P. 1643-1647. ↑

C738. Harish B.P. Bridging technology-CAD and design-CAD for variability aware Nano-CMOS circuits. / Harish B.P., Bhat N., Patil M.B. // 2009. ISCAS 2009. IEEE International Symposium on Circuits and Systems. - Taipei, 24-27 May 2009. - P. 2309-2312. ↑

C739. Sawigun C. Nanopower sampled data wavelet filter design using Switched Gain Cell technique. / Sawigun C., Grashuis M., Peeters R., Serdijn W. // 2009. ISCAS 2009. IEEE International Symposium on Circuits and Systems. - Taipei, 24-27 May 2009. - P. 545-548. ↑

C740. Sheng Lin. Soft-Error Hardening Designs of Nanoscale CMOS Latches. / Sheng Lin, Yong-Bin Kim, Lombardi F. // 2009. VTS 09. 27th IEEE VLSI Test Symposium. - Santa Cruz, CA, 3-7 May 2009. - P. 41-46. ↑

C741. Day-Uei Li. FPGA implementation of a video-rate fluorescence lifetime imaging system with a 32432 CMOS single-photon avalanche diode array. / Day-Uei Li, Walker R., Richardson J., Rae B., Buts A., Renshaw D., Henderson R. // 2009. ISCAS 2009. IEEE International Symposium on Circuits and Systems. - Taipei, 24-27 May 2009. - P. 3082-3085. ↑

C742. Ok Z.D. Nanotechnology environmental, health, and safety issues: brief literature review since 2000. / Ok Z.D., Benneyan J.C., Isaacs J.A. // 2009. ISSST '09. IEEE International Symposium on Sustainable Systems and Technology. - Phoenix, AZ, 18-20 May 2009. - P. 1-5. ↑

C743. Ho Shing Poon. Noiseless and vibration-free Ionic Propulsion technology for indoor surveillance blimps. / Ho Shing Poon, Lam Mark K. K., Chow Maxwell, Li Wen J. // 2009. ICRA '09. IEEE International Conference on Robotics and Automation. - Kobe, 12-17 May 2009. - P. 2891-2896. ↑

C744. Pathak R. Optimizing HPC and parallelization for computation Nanotechnology in MCCA environment. / Pathak R., Joshi S., Ahmed S., Mishr D. // 2009. ECTI-CON 2009. 6th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology. - Pattaya, Chonburi, 6-9 May 2009. - Vol. 02. - P. 712-715. ↑

C745. Yexin Zheng. Defect-aware logic mapping for nanowire-based programmable logic arrays via satisfiability. / Yexin Zheng, Chao Huang. // 2009. DATE '09. Design, Automation & Test in Europe Conference & Exhibition. - Nice, 20-24 April 2009. - P. 1279-1283. ↑
















C746. Owada T. Advanced BEOL integration using porous low-k ( $k=2.25$ ) material with charge damage-less electron beam cure technique. / Owada T., Ohara N., Watatani H., Kouno T., Kudo H., Ochimizu H., Sakoda T., Asami N., Ohkura Y., Fukuyama S., Tsukune A., Nakaishi M., Nakamura T., Nara Y., Kase M. // 2009. IITC 2009. IEEE International Interconnect Technology Conference. - Sapporo, Hokkaido, 1-3 June 2009. - P. 149-151. ↑

C747. Wang S. Metrology of 3D IC with X-ray Microscopy and nano-scale X-ray CT. / Wang S., Gelb J., Lau S.H., Wenbing Yun. // 2009. IITC 2009. IEEE International Interconnect Technology Conference. - Sapporo, Hokkaido, 1-3 June 2009. - P. 131-133. ↑



- C748.** Seo K. New multi-step UV curing process for porogen-based porous SiOC. / Seo K., Oka Y., Nomura K., Tsutsue M., Kobori E., Goto K., Mizukami Y., Ohtsuka T., Tsukamoto K., Matsumoto S., Ueda T. // 2009. IITC 2009. IEEE International Interconnect Technology Conference. - Sapporo, Hokkaido, 1-3 June 2009. - P. 101-103. ↑
- C749.** Athey B. "Keeping up with Bioinformatics and Computational Biology as applied to biomedicine-Where has it been? Where is it going?". 2009. BSEC 2009. First Annual ORNL Biomedical Science & Engineering Conference. - Oak Ridge, TN, 18-19 March 2009. - P. 1-2. ↑
- C750.** Chen Dong. Reconfigurable circuit design with nanomaterials. / Chen Dong, Chilstedt S., Deming Chen. // 2009. DATE '09. Design, Automation & Test in Europe Conference & Exhibition. - Nice, 20-24 April 2009. - P. 442-447. ↑
- C751.** Fujita S. Nano-electronics challenge chip designers meet real nano-electronics in 2010s?. 2009. DATE '09. Design, Automation & Test in Europe Conference & Exhibition. - Nice, 20-24 April 2009. - P. 431-432. ↑
- C752.** Tuan Vo-Dinh. Nano-biophotonics: From laboratory research to biomedical diagnostics. 2009. BSEC 2009. First Annual ORNL Biomedical Science & Engineering Conference. - Oak Ridge, TN, 18-19 March 2009. - P. 1-2. ↑
- C753.** Kanoun O. Future prospects for smart sensor systems. 2009. SSD '09. 6th International Multi-Conference on Systems, Signals and Devices. - Djerba, 23-26 March 2009. - P. 1-6. ↑
- C754.** Khan S. Semi-autonomous scheme for pushing micro-objects. / Khan S., Sabanovic A. // 2009. ICIT 2009. IEEE International Conference on Industrial Technology. - Gippsland, VIC, 10-13 Feb. 2009. - P. 1-7. ↑
- C755.** Auersperg J. Crack and damage evaluation in low-k BEoL stacks under chip package interaction aspects. / Auersperg J., Vogel D., Lehr M.U., Grillberger M., Michel B. // 2009. EuroSimE 2009. 10th International Conference on Thermal, Mechanical and Multi-Physics simulation and Experiments in Microelectronics and Microsystems. - Delft, 26-29 April 2009. - P. 1-6. ↑
- C756.** Gessner T. Smart systems integratio by using micro- and nanotechnologies. / Gessner T., Reuter D. // 2009. SSD '09. 6th International Multi-Conference on Systems, Signals and Devices. - Djerba, 23-26 March 2009. - P. 1-8. ↑
- C757.** Takeuchi Ken. F1: SSD memory subsystem innovation. 2009. ISSCC 2009. IEEE International Solid-State Circuits Conference-Digest of Technical Papers. - San Francisco, CA, 8-12 Feb. 2009. - P. 504. ↑
- C758.** Yao-Joe Yang. A release-on-demand wireless CMOS drug delivery SoC based on electrothermal activation technique. / Yao-Joe Yang, Yu-Jie Huang, Hsin-Hung Liao, Tao Wang, Pen-Li Huang, Chii-Wan Lin, Yao-Hong Wang, Shey-shi Lu. // 2009. ISSCC 2009. IEEE International Solid-State Circuits Conference-Digest of Technical Papers. - San Francisco, CA, 8-12 Feb. 2009. - P. 288-289,289a. ↑
- C759.** Mahdavi M. SEU Effects on QCA Circuits. / Mahdavi M., Amiri M.A., Mirzakuchaki S. // 2009. ICTD 2009. IEEE Circuits and Systems International Conference on Testing and Diagnosis. - Chengdu, 28-29 April 2009. - P. 1-3. ↑
- C760.** Dudek R. Thermo-mechanical reliability assessment for 3D through-Si stacking. / Dudek R., Bramer B., Irsigler R., Rzepka S., Michel B. // 2009. EuroSimE 2009. 10th International Conference on Thermal, Mechanical and Multi-Physics simulation and Experiments in Microelectronics and Microsystems. - Delft, 26-29 April 2009. - P. 1-7. ↑
- C761.** {no data available}. Table of contents. 2009. iWAT 2009. IEEE International Workshop on Antenna Technology. - Santa Monica, CA, 2-4 March 2009. - P. 1-10. ↑
- C762.** DiMarzio C.A. Three-dimensional multi-modal microscopy. 2009. CME. ICME International Conference on Complex Medical Engineering. - Tempe, AZ, 9-11 April 2009. - P. 1-4. ↑
- C763.** Abe S. Suppression of DIBL in deca-nano SOI MOSFETs by controlling permittivity and thickness of BOX layers. / Abe S., Miyazawa Y., Nakajima Y., Hanajiri T., Toyabe T., Sugano T. // 2009. ULIS 2009. 10th International Conference on Ultimate Integration of Silicon. - Aachen, 18-20 March 2009. - P. 329-332. ↑



- C764.** Jiuyang Lin. Nanofiltration and Ion-Exchange Alkalinization for Water Conservation and Zerodischarge in Circulating Cooling Water System. / Jiuyang Lin, Chunsong Ye, Huiming Zeng, Fei Yu, Xing Xiao. // 2009. APPEEC 2009. Asia-Pacific Power and Energy Engineering Conference. - Wuhan, 27-31 March 2009. - P. 1-4. 
- C765.** El Sabbagh M. Quantum compact model for ballistic double gate MOSFETs. / El Sabbagh M., Fikry W., Omar O.A. // 2009. DTIS '09. 4th International Conference on Design & Technology of Integrated Systems in Nanoscale Era. - Cairo, 6-9 April 2009. - P. 144-146. 
- C766.** Mori S. Nano-motion stage for high speed and precision positioning on an X-Y plane. / Mori S., Sato Y., Sakurada A., Naganawa A., Shibuya Y., Obinata G. // 2009. APMRC '09. Asia-Pacific Magnetic Recording Conference. - Singapore, 14-16 Jan. 2009. - P. 1-2. 
- C767.** Sommer J.-P. Active components embedded into organic boards-Accelerated design by means of finite element simulation and micro deformation measurements. / Sommer J.-P., Michel B., Noack E., Seiler B. // 2009. MEMS/MOEMS '09. Symposium on Design, Test, Integration & Packaging of MEMS/MOEMS. - Rome, 1-3 April 2009. - P. 338-342. 
- C768.** Yen-Chun Tseng. An electrically driven quasi-L2 photonic crystal nano-cavity with a small mode volume. / Yen-Chun Tseng, Tzu-Yi Chi, Wen-Yen Chen, Pei-Chin Chiu, Chun-Jun Wang, Tzu-Min Hsu, Jen-Inn Chyi. // 2009. IPRM 09. IEEE International Conference on Indium Phosphide & Related Materials. - Newport Beach, CA, 10-14 May 2009. - P. 35-36. 
- C769.** Ju Seok Lee. Exploring the potential of microarray technology for bio/nano sensing. / Ju Seok Lee, Joon Jin Song, Deaton R., Jin-Woo Kim. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 1065-1068. 
- C770.** Liang Xue. MEMS-based multi-sensor integrated attitude estimation technology for MAV applications. / Liang Xue, Weizheng Yuan, Honglong Chang, Chengyu Jiang. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 1031-1035. 
- C771.** Subramanian S. Design and analysis of helical flagella propelled nanorobots. / Subramanian S., Rathore J.S., Sharma N.N. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 950-953. 
- C772.** Osawa Eiji. Plenary lecture 3: "Recent progress in developments of single-nano diamond particles". 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, China, 5-8 Jan. 2009. - P. xvii-xviii. 
- C773.** Li Wen J. CNT-based extreme low-power micro motion sensors. 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, China, 5-8 Jan. 2009. - P. xxxiv. 
- C774.** Stauffer Urs. Keynote lecture 3: "MEMS as tools for nanotechnology". 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, China, 5-8 Jan. 2009. - P. xxvi-xxvii. 
- C775.** Arai Fumihito. Plenary lecture 5: "Bio-medical micro-nano robotics". 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, China, 5-8 Jan. 2009. - P. xx-xxi. 
- C776.** Yiting Yu. Two new micro programmable gratings and their potential applications. / Yiting Yu, Weizheng Yuan, Bin Yan, Taiping Li, Lanlan Wang. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 946-949. 
- C777.** Jianbing Xie. A novel method for the manufacture of MEMS devices with large exposed area based on SOI wafers. / Jianbing Xie, Weizheng Yuan, Honglong Chang. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 253-256. 
- C778.** Hao Ruican. Preparation of kerosene based nano-magnetic fluid and its application in pressure difference sensors. / Hao Ruican, Li Decai. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 47-50. 



- C779.** Lin T.D. Nano-electronics of high  $\kappa$  dielectrics on InGaAs for key technologies beyond Si CMOS. / Lin T.D., Chang P., Chiu H.C., Chang Y.C., Lin C.A., Chang W.H., Lee Y.J., Chang Y.H., Huang M.L., Kwo J., Hong M. // 2009. IPRM 09. IEEE International Conference on Indium Phosphide & Related Materials. - Newport Beach, CA, 10-14 May 2009. - P. 94-99. ↑
- C780.** Xin Xu. Finite elements study of high mechanical stress in nanostructures for innovative NEMS sensors. / Xin Xu, Bercu B., Lime F., Montes L. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 676-681. ↑
- C781.** Guanghui Bai. Kinetic and processing studies on a novel technology of producing high purity nano-silicon dioxide from an alumina rich coal fly ash with carbon dioxide. / Guanghui Bai, Wei Teng, Xianggang Wang, Hui Zhang, Peng Xu. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 837-842. ↑
- C782.** Yung-Chun Lee. Infrared heating and roller-based contact printing technology for the fabrication of micro/nano-structures. / Yung-Chun Lee, Hsueh-Liang Chen, Chun-Hung Chen, Hung-Yi Lin. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 779-782. ↑
- C783.** Han G.Q. Fabrication and characterization of nano-scale lines through anodic porous alumina membrane. / Han G.Q., Jiang Z.D., Jing W.X., Wang H.R., Sun G.L., Zhu M.Z. // 2009. NEMS 2009. 4th IEEE International Conference on Nano/Micro Engineered and Molecular Systems. - Shenzhen, 5-8 Jan. 2009. - P. 722-725. ↑
- C784.** Inagaki N. Temperature controlled miniaturized cell in magnetic beads handling system for bio-chemical reaction. / Inagaki N., Imai R., Shikida M., Okochi M., Honda H., Sato K. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 382-385. ↑
- C785.** Hirabayashi M. Toward self-assembly of phage-like nanorobot. / Hirabayashi M., Oiwa K., Nishikawa A., Tanaka F., Hagiya M. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 530-535. ↑
- C786.** Cannara R.J. Multiscale thermoelectric imaging for fast metrology and manipulation. / Cannara R.J., Sebastian A., Gotsmann B., Rothuizen H. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 781-783. ↑
- C787.** Chunlei Tan. Fabricate planar photonic crystal gradient index lens by laser interference lithography. / Chunlei Tan, Peng C.S., Jin Zhang, Wang Zuobin, Petryakov V.N., Verevkin Yu.K., Olaizola S.M., Berthou T., Tisserand S. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 450-453. ↑
- C788.** Biazi L.A. Droplet and Dielectrophoresis deposition of single-wall carbon nanotubes. / Biazi L.A., Collini C., Guarnieri V., Lago A., Marchiori R., Gottardi G., Morganti E., Lorenzelli L. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 575-578. ↑
- C789.** Bucko M.M. Ionic conductivity of the yttria-stabilized-zirconia nanomaterials. 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 543-546. ↑
- C790.** Nakamura H. Strain effects on the band structure for Si nanowires. 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 555-558. ↑
- C791.** Graziano M. A technology aware magnetic QCA NCL-HDL architecture. / Graziano M., Chiolerio A., Zamboni M. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 763-766. ↑
- C792.** Wood J.D. Carbon nanotube alignment using meniscus action. / Wood J.D., Lyding J.W. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 475-476. ↑
- C793.** Martinez J. Silicon nanowire transistor with a channel width of 4 nm fabricated by atomic force microscope nanolithography. / Martinez J., Martinez R.V., Garcia R. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 442-443. ↑



- C794.** Agbo I. Implementable building blocks for fluctuation based calculation in single electron tunneling technology. / Agbo I., Safiruddin S., Cotofana S. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 366-369. ↑
- C795.** Sahoo D.R. Magnetoresistive sensor based scanning probe microscopy. / Sahoo D.R., Sebastian A., Haberle W., Pozidis H., Eleftheriou E. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 862-865. ↑
- C796.** Stiff-Roberts A.D. Quantum dot infrared photodetectors: Advantages, challenges, and future research directions. 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 444-449. ↑
- C797.** Dinh-Trong N. Influence of the composition of MWCNTs layers on the properties of strain gauges. / Dinh-Trong N., Steitz J., Lei Bu, Kanoun O. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 477-480. ↑
- C798.** Scarpa G. Pattern generation by using high-resolution nanoimprinting and nanotransfer printing techniques. / Scarpa G., Harrer S., Abdellah A., Penso-Blanco G., Lugli P., Strobel S., Abstreiter G., Tornow M. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 432-438. ↑
- C799.** Abdellah A. Exploring spray technology for the fabrication of organic devices based on poly(3-hexylthiophene). / Abdellah A., Baierl D., Fabel B., Lugli P., Scarpa G. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 831-934. ↑
- C800.** Mussi V. DNA-functionalized nanopores for single molecule analysis. / Mussi V., Fanzio P., Repetto L., Firpo G., Valbusa U., Stigliani S., Scaruffi P., Tonini G.-P. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 682-684. ↑
- C801.** WeiSheng Zhao. Behavioral model of carbon nanotube programmable resistors. / WeiSheng Zhao, Gamrat C., Agnus G., Derycke V., Filoramo A., Bourgoin J.-P. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 713-716. ↑
- C802.** Chui S.T. Finite frequency response of nano magnetic structures. / Chui S.T., Novosad V., Bader S.D. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 659-662. ↑
- C803.** Serrano-Gotarredona T. Fast and compact simulation models for a variety of FET nano devices by the CMOS EKV equations. / Serrano-Gotarredona T., Linares-Barranco B., Agnus G., Derycke V., Bourgoin J.-P., Alibart F., Vuillaume D., Sohn J., Bendall J., Welland M.E., Gamrat C. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 691-694. ↑
- C804.** Hammerstrom D. Prospects for building cortex-scale CMOL/CMOS circuits: A design space exploration. / Hammerstrom D., Zaveri M.S. // 2009 NORCHIP. - Trondheim, 16-17 Nov. 2009. - P. 1-8. ↑
- C805.** Aghababa H. A robust method to estimate Power and Delay for Digital Integrated Circuits. / Aghababa H., Forouzandeh B., Dehghan H., Afzali-Kusha A. // 2009 NORCHIP. - Trondheim, 16-17 Nov. 2009. - P. 1-5. ↑
- C806.** Valinataj M. A link failure aware routing algorithm for Networks-on-Chip in nano technologies. / Valinataj M., Mohammadi S., Safari S., Plosila J. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 687-690. ↑
- C807.** Hoshino T. Muscle-powered nano mechanical system assembled by optical tweezers. / Hoshino T., Kuroda H., Konno T., Ishihara K., Kometani R., Morishima K. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 636-639. ↑
- C808.** Sulieman M.H. Threshold-voltage variations effects on the reliability of nano-scale CMOS logic gates. 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 744-747. ↑
- C809.** Mosiello L. Toxicity of toner nanoparticles on RT112 cell cultures. / Mosiello L., Zappa G., Zoani C., Lamberti I., Gatti R., Pilloni L. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 616-618. ↑



- C810.** Angeli E. Tunable elastomeric nanochannels for separation and manipulation of long DNA molecules. / Angeli E., Manneschi C., Repetto L., Firpo G., Boragno C., Valbusa U. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 626-629. ↑
- C811.** Ruffini A. Biomorphic transformation to obtain hierarchical porous structures. / Ruffini A., Sprio S., Tampieri A. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 609-612. ↑
- C812.** Stefanou A. Density functional theory analysis of SiO<sub>2</sub>-oxynitride interfaces. 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 722-724. ↑
- C813.** Ahmad M.R. Single cells electrical characterizations using nanoprobe via ESEM-nanomanipulator system. / Ahmad M.R., Nakajima M., Fukuda T., Kojima S., Homma M. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 589-592. ↑
- C814.** Kox R. Shrinking solid-state nanopores and nanoslits using electron beam induced deposition with different precursors. / Kox R., Chang Chen, Lagae L., Borghs G. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 605-608. ↑
- C815.** Inomata N. Evaluation of thermal conduction of single carbon nanotube by local heating in air. / Inomata N., Kato T., Arai F. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 850-853. ↑
- C816.** Kawazome M. Low temperature wiring with Ag inks: New  $\beta$ -ketocarboxylate Ag inks for 100 °C curing. / Kawazome M., Keun-Soo Kim, Suganuma K. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 4-6. ↑
- C817.** Ibrahim W. How much input vectors affect nano-circuit's reliability estimates. / Ibrahim W., Beiu V., Amer H. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 699-702. ↑
- C818.** Wei Su. New noise-tolerant dynamic circuit design. / Wei Su, Song Jia, Xiayu Li, Limin Liu, Yuan Wang. // 2009. EDSSC 2009. IEEE International Conference of Electron Devices and Solid-State Circuits. - Xi'an, 25-27 Dec. 2009. - P. 254-257. ↑
- C819.** Yi Li. NANO materials and composites for electronic and photo packaging. / Yi Li, Zhang R., Lingbo Zhu, Lin W., Hildreth O., Hongjin Jiang, Jiongxin Lu, Yonghao Xiu, Liu Y., Moon J., Wong C.P. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 1-3. ↑
- C820.** Chiariello A.G. Carbon nanotube bundles as nanoscale chip to package interconnects. / Chiariello A.G., Miano G., Maffucci A. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 58-61. ↑
- C821.** Serra A. Local density of states and electronic transport properties of homotype SWCNTs bundles. / Serra A., Manno D., Filippo E., Terranova M.L., Orlanducci S., Rossi M. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 79-82. ↑
- C822.** Strobel S. Silicon based nanogap device for investigating electronic transport through 12 nm long oligomers. / Strobel S., Sondergaard R., Bundgaard E., Norrman K., Krebs F.C., Albert E., Csaba G., Lugli P., Hansen A.G., Tornow M. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 83-85. ↑
- C823.** Chun-Jen Weng. Optimization of sub-100nm transistor gate sidewall spacer process for high-performance applications. 2009. EDSSC 2009. IEEE International Conference of Electron Devices and Solid-State Circuits. - Xi'an, 25-27 Dec. 2009. - P. 50-53. ↑
- C824.** Wang D. Pulsed discharge plasma generated by nano-seconds pulsed power in atmospheric air. / Wang D., Namihira T., Akiyama H. // 2009. PPC '09. IEEE Pulsed Power Conference. - Washington, DC, June 28 2009-July 2 2009. - P. 1046-1049. ↑
- C825.** Stern L. The Nano-Atomic-Clock. / Stern L., Stern A., Levy B. // 2009. COMCAS 2009. IEEE International Conference on Microwaves, Communications, Antennas and Electronics Systems. - Tel Aviv, 9-11



Nov. 2009. - P. 1. ↑

**C826.** Young-Min Shin. MEMS-integrated ultra-wideband terahertz traveling wave tube amplifier. / Young-Min Shin, Jinfeng Zhao, Barnett L.R., Luhmann N.C. // 2009. APMC 2009. Asia Pacific Microwave Conference. - Singapore, 7-10 Dec. 2009. - P. 2308-2311. ↑

**C827.** Shaomao Li. Field emission characteristics of carbon nano tubes under varying background pressure conditions. / Shaomao Li, Kirkici H. // 2009. PPC '09. IEEE Pulsed Power Conference. - Washington, DC, June 28 2009-July 2 2009. - P. 693-696. ↑

**C828.** Byeong-Ha Park. Mixed-signal ICs in nano-scale technologies: Design and challenges. 2009. EDSSC 2009. IEEE International Conference of Electron Devices and Solid-State Circuits. - Xi'an, 25-27 Dec. 2009. - P. 2. ↑

**C829.** Mohanty S.P. ILP based leakage optimization during nano-CMOS RTL synthesis: A DOXCMOS Versus DTCMOS perspective. / Mohanty S.P., Panigrahi B.K. // 2009. NaBIC 2009. World Congress on Nature & Biologically Inspired Computing. - Coimbatore, 9-11 Dec. 2009. - P. 1367-1372. ↑

**C830.** {no data available}. Copyright. 2009. NaBIC 2009. World Congress on Nature & Biologically Inspired Computing. - Coimbatore, 9-11 Dec. 2009. - P. 1. ↑

**C831.** Valentini F. Study of biomineralization processes by cryo-TEM. / Valentini F., Landi E., Sandri M., Sommerdijk N., Nudelman F., Tampieri A. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 348-350. ↑

**C832.** Augustine C. Nano-magnet based ultra-low power logic design using non-majority gates. / Augustine C., Behin-Aein B., Roy K. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 870-873. ↑

**C833.** Pennelli G. Metal nanojunctions on silicon single nanowire devices. / Pennelli G., Piotta M. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 295-298. ↑

**C834.** Bianco S. Morphology and magnetic properties of island-like Co films obtained by de-wetting as catalysts for carbon nanotube arrays. / Bianco S., Gupta S., Tiberto P., Martino P., Chiolerio A., Celegato F., Pandolfi P., Tagliaferro A., Allia P. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 878-879. ↑

**C835.** Mohammadzadeh S. Geometry dependent I-V characteristics of gold atomic-sized contacts. / Mohammadzadeh S., Streiter R., Gessner T. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 884. ↑

**C836.** Paul S. Nanoscale reconfigurable computing using non-volatile 2-D STTRAM array. / Paul S., Chatterjee S., Mukhopadhyay S., Bhunia S. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 880-883. ↑

**C837.** Kai Hahn. Micro and nano product engineering using data management for silicon-based fabrication process development. / Kai Hahn, Schmidt T., Mielke M., Bruck R., Orloff D. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 337-340. ↑

**C838.** Demarchi D. Nanoelectronics lab based on nanogap fabrication. / Demarchi D., Civera P., Piccinini G. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 236-239. ↑

**C839.** Helal M. Micro/nano grip and move compliant mechanism with parallel movement tips. / Helal M., Liguio Chen, Lining Sun, Bing Shao. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 130-132. ↑

**C840.** Byrne R. Beads, boats and switches: Making things happen with molecular photoswitches. / Byrne R., Lopez F., Scaramagnani S., Higgins M., Wallace G.G., Diamond D. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 139-143. ↑

**C841.** Brunetti F. Field emission behaviour of nickel nanowires grown by electrochemical deposition. / Brunetti F., Ulisse G., Ciceroni C., Di Carlo A., Tamburri E., Gugliemotti V., Terranova M.L. // 2009. IEEE-NANO 2009.



9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 160-162. ↑

C842. Manem H. A crosstalk minimization technique for sublithographic programmable logic arrays. / Manem H., Rose G.S. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 218-221. ↑

C843. Srivastava S. Repair techniques for hybrid Nano/CMOS computational architecture. / Srivastava S., Melouki A., Al-Hashimi B.M. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 198-201. ↑

C844. Guoqing Deng. Full adder design using hybrid CMOS-SET parallel architectures. / Guoqing Deng, Guoyan Ren, Chunhong Chen. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 206-209. ↑

C845. Beiu V. On brain-inspired hierarchical network topologies. / Beiu V., Madappuram B.A.M., Kelly P.M., McDaid L.J. // 2009. IEEE-NANO 2009. 9th IEEE Conference on Nanotechnology. - Genoa, 26-30 July 2009. - P. 202-205. ↑

C846. Mazreah Arash Azizi. A Nanoscale CMOS SRAM Cell for High Speed Applications. / Mazreah Arash Azizi, Shalmani Mohammad Taghi Manzuri, Mehrparvar Ali. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 33-36. ↑

C847. Sayyaf Nima. Design and Fabrication of a Novel Micro Angle Sensor. / Sayyaf Nima, Barazandeh Farshad, Nejad Saman Nazari, Razfar Mohammad Reza. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 37-40. ↑

C848. Hinchey M. Invited Speaker: Formally Specifying Autonomous and Agent-Based NASA Space Exploration Missions. 2009 Fourth South-East European Workshop on Formal Methods (SEEFM). - Thessalonih, 4-5 Dec. 2009. - P. ix. ↑

C849. Tang Wenzhong. The Research of a Business Rule Management Method for Virtual Organization. / Tang Wenzhong, Qin Jingyi. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 25-28. ↑

C850. Aziz Noor Hafizah Abdul. Wireless System for Temperature Monitoring in Oil Palm Bio-laboratory. / Aziz Noor Hafizah Abdul, Othman Kama Azura, Sarnin Suzi Seroja, Ali Yuhaini Idayu Mohd. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 234-238. ↑

C851. Qing Xia. The Master-Slave Control System Design and Implementation by Serial Communication. 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 239-242. ↑

C852. Tang Jun. Research on Software Design of DSP Motion Controller. / Tang Jun, Zhao Xiaojuan. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 249-253. ↑

C853. Hasani J.Y. Analysis of high frequency effects in the intrinsic part of nano-metre scale MOS devices in millimeter wave band. / Hasani J.Y., Kamarei M., Ndagijimana F. // 2009 First Conference on Millimeter-Wave and Terahertz Technologies (MMWaTT). - Tehran, 29-31 Dec. 2009. - P. 15-20. ↑

C854. Jia-shan Xu. Study on a micro-knife and its vibration signal acquisition system. / Jia-shan Xu, Hang Guo. // Joint Conference of the 2009 Symposium on Piezoelectricity, Acoustic Waves, and Device Applications (SPAWDA) and 2009 China Symposium on Frequency Control Technology. - Wuhan, 17-20 Dec. 2009. - P. 131. ↑

C855. Feng Pan. Preparation and characterization of Al-doped ZnO piezoelectric thin films. / Feng Pan, Hang Guo. // Joint Conference of the 2009 Symposium on Piezoelectricity, Acoustic Waves, and Device Applications (SPAWDA) and 2009 China Symposium on Frequency Control Technology. - Wuhan, 17-20 Dec. 2009. - P. 122. ↑

C856. Zheng Huang. Nonlinear modeling of piezoelectric actuator based on SVR. / Zheng Huang, Cong-wei Lv, Wen-ying Yang, Jian-huan Zhang. // Joint Conference of the 2009 Symposium on Piezoelectricity, Acoustic



Waves, and Device Applications (SPAUDA) and 2009 China Symposium on Frequency Control Technology. - Wuhan, 17-20 Dec. 2009. - P. 93. ↑

**C857.** Das N. Electrical characterization of resistive memory in metal-Pr<sub>0.7</sub> Ca<sub>0.3</sub> MnO<sub>3</sub> interface: A future non-volatile memory device. / Das N., Xue Y.Y., Wang Y.Q., Chu C.W. // 2009 10th Annual Non-Volatile Memory Technology Symposium (NVMTS). - Portland, OR, 25-28 Oct. 2009. - P. 28-47. ↑

**C858.** Arora V.K. The role of ballistic mobility and saturation velocity in performance evaluation of a nano-CMOS circuit. / Arora V.K., Chek D.C.Y., Tan M.L.P. // 2009. ELECTRO '09. International Conference on Emerging Trends in Electronic and Photonic Devices & Systems. - Varanasi, 22-24 Dec. 2009. - P. 14-17. ↑

**C859.** Siti M.M.H. Characterization of on-wafer RF passive components for RFIC devices using three-steps de-embedding method. / Siti M.M.H., Mohd N.O., Marzuki A., Rahim A.I.A., Mohamed R.Y. // 2009 IEEE 9th Malaysia International Conference on Communications (MICC). - Kuala Lumpur, 15-17 Dec. 2009. - P. 362-366. ↑

**C860.** Farid N.E. A variable gain, 2.5 GHz CMOS low-noise amplifier for mobile wireless communications. / Farid N.E., Marzuki A., Rahim A. // 2009 IEEE 9th Malaysia International Conference on Communications (MICC). - Kuala Lumpur, 15-17 Dec. 2009. - P. 885-889. ↑

**C861.** Peng Yun. Design and development of megasonic system and its application to PZT nano powder dispersion. / Peng Yun, Wang Wei. // International Technology and Innovation Conference 2009 (ITIC 2009). - Xian, China, 12-14 Oct. 2009. - P. 1-6. ↑

**C862.** Amiri Mohammad Amin. LUT-Based QCA Implementation of a 4x4 S-Box. / Amiri Mohammad Amin, Mahdavi Mojdeh, Mirzakuchaki Sattar. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 56-59. ↑

**C863.** Mahdavi Mojdeh. Single Electron Fault in QCA Inverter Gate. / Mahdavi Mojdeh, Amiri Mohammad Amin, Mirzakuchaki Sattar, Moghaddasi Mohammad Naser. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 63-66. ↑

**C864.** Junfa Mao. Applications of Carbon nanotube technology for next-generation high speed and microwave circuits. 2009. ICMTCE. International Conference on Microwave Technology and Computational Electromagnetics. - Beijing, China, 3-6 Nov. 2009. - P. 7. ↑

**C865.** Amiri Mohammad Amin. Logic-based QCA implementation of a 4x4 S-Box. / Amiri Mohammad Amin, Mahdavi Mojdeh, Mirzakuchaki Sattar. // 2009 5th IEEE GCC Conference & Exhibition. - Kuwait City, Kuwait, 17-19 March 2009. - P. 1-5. ↑

**C866.** Bartling B. Development of nano-metallic catalysts for the single-use, disposable biomedical sensor platform technology. / Bartling B., Lei Fang, Chou L.C.S., Lu Li, Shih-Hong Chang, Bing-Joe Hwang, Chung-Chiun Liu. // 2009 IEEE International Conference on Nano/Molecular Medicine and Engineering (NANOMED). - Tainan, 18-21 Oct. 2009. - P. 253-258. ↑

**C867.** Joshi S. Modeling and analysis of Nano enable solar and fuel cell systems. / Joshi S., Pathak R. // 2009 IEEE PES/IAS Conference on Sustainable Alternative Energy (SAE). - Valencia, 28-30 Sept. 2009. - P. 1-6. ↑

**C868.** Ahmad N. Ocimum Mediated Biosynthesis of Silver Nanoparticles. / Ahmad N., Alam M.K., Singh V.N., Shamsi S.F., Sharma S. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, 28-30 Dec. 2009. - P. 80-84. ↑

**C869.** Yang Xueyan. Application of RFID Technology in Heat Meters. / Yang Xueyan, Ma Rujian, Wang Xiao, Ren Guoxian. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 199-202. ↑

**C870.** Sayed A. Computational Experience with Nano-material Science Quantum Monte Carlo Modeling on BlueGene/L. / Sayed A., El-Shishiny H. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, 28-30 Dec. 2009. - P. 213-217. ↑

**C871.** Aziz Noor Hafizah Abdul. Smart Integrated Sensors in Real Time Monitoring Critical Parameters in Tissue Culture Growth Room of Oil Palm. / Aziz Noor Hafizah Abdul, Wahab Norfishah Abdul, Muhamad Wan Norsyafizan W., Alias Ahmad Jais, Hashim Ahmad Tarmizi, Mustafa Rozita. // 2009 Fifth International



Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 229-233. ↑

**C872.** Naim Nani Fadzlina. Offline Analysis of High Frequency Digital Signal. / Naim Nani Fadzlina, Mat Mohd Zaidi Che Sarnin Suzi Seroja, Muhamad Wan Norsyafizan Wan, Saad Hasnida, Sha'ameri Ahmad Zuri. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 176-180. ↑

**C873.** Javid Mohamad. Characterization and Tolerance of QCA Full Adder under Missing Cells Defects. / Javid Mohamad, Mohamadi Karim. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 85-88. ↑

**C874.** Zhang Yue. 3D Simulation for Vehicle Maneuvering along Path Accurately. / Zhang Yue, Wang Jun, Lv Huifang, Jiang Fan, Chen Gang. // 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 149-153. ↑

**C875.** Kawitkar Rameshwar. Performance of Different Types of Array Structures Based on Multiple Signal Classification (MUSIC) Algorithm. 2009 Fifth International Conference on MEMS, NANO, and Smart Systems (ICMENS). - Dubai, United Arab Emirates, 28-30 Dec. 2009. - P. 159-161. ↑

**C876.** Yao-Jen Lee. 3D 65nm CMOS with 320°C microwave dopant activation. / Yao-Jen Lee, Yu-Lun Lu, Fu-Kuo Hsueh, Kuo-Chin Huang, Chia-Chen Wan, Tz-Yen Cheng, Ming-Hung Han, Kowalski J.M., Kowalski J.E., Dawei Heh, Hsi-Ta Chuang, Yiming Li, Tien-Sheng Chao, Ching-Yi Wu, Fu-Liang Yang. // 2009 IEEE International Electron Devices Meeting (IEDM). - Baltimore, MD, 7-9 Dec. 2009. - P. 1-4. ↑

**C877.** Pandit S. A compact threshold voltage model for narrow channel nano-scale MOSFETs. / Pandit S., Sarkar C.K. // 2009. CODEC 2009. 4th International Conference on Computers and Devices for Communication. - Kolkata, 14-16 Dec. 2009. - P. 1-4. ↑

**C878.** Pavesi L. Nanosilicon photonics. 2009. CODEC 2009. 4th International Conference on Computers and Devices for Communication. - Kolkata, 14-16 Dec. 2009. - P. 1. ↑

**C879.** Das K. A novel approach of And-Or-Inverter (AOI) gate design for QCA. / Das K., De D. // 2009. CODEC 2009. 4th International Conference on Computers and Devices for Communication. - Kolkata, 14-16 Dec. 2009. - P. 1-4. ↑

**C880.** Martin A.J. Asynchronous logic for high variability nano-CMOS. 2009. ICECS 2009. 16th IEEE International Conference on Electronics, Circuits, and Systems. - Yasmine Hammamet, 13-16 Dec. 2009. - P. 69-72. ↑

**C881.** Farazmand N. Online multiple error detection in crossbar nano-architectures. / Farazmand N., Tahoori M.B. // 2009. ICCD 2009. IEEE International Conference on Computer Design. - Lake Tahoe, CA, 4-7 Oct. 2009. - P. 335-342. ↑

**C882.** Rennie D.J. Design challenges in nanometric embedded memories. / Rennie D.J., Shakir T., Sachdev M. // 2009 3rd International Conference on Signals, Circuits and Systems (SCS). - Medenine, 6-8 Nov. 2009. - P. 1-8. ↑

**C883.** Fedoseyev A.I. Analysis and modeling of space radiation effects in quantum dot based nanomaterials for high-efficiency photovoltaic cells. / Fedoseyev A.I., Turowski M., Raman A., Balandin A.A., Qinghui Shao, Hubbard S., Polly S., Taylor E.W. // 2009 34th IEEE Photovoltaic Specialists Conference (PVSC). - Philadelphia, PA, 7-12 June 2009. - P. 000462-000464. ↑

**C884.** Gao H. Enhanced spontaneous emission of electric dipole by nano-optical antenna. / Gao H., Li K., Kong F. M., Xie H., Zhao J. // 2009 Asia Communications and Photonics Conference and Exhibition (ACP). - Shanghai, China, 2-6 Nov. 2009. - Vol. 2009-Supplement. - P. 1-10. ↑

**C885.** Jun Liu. Design, fabrication, and preliminary test of multi-layers nano resonant tunneling film gyroscope. / Jun Liu, Kang Du, Mengwei Li, Yunbo Shi. // 2009 IEEE Sensors. - Christchurch, 25-28 Oct. 2009. - P. 526-531. ↑

**C886.** Ueno S. Recent advances in biomagnetics and bioimaging for brain research and sensing technologies.



2009 IEEE Sensors. - Christchurch, 25-28 Oct. 2009. - P. 1-6. ↑

**C887.** Roy K. Design in the nano-scale Era: Low-power, reliability, and error resiliency. 2009. SOCC 2009. IEEE International SOC Conference. - Belfast, 9-11 Sept. 2009. - P. 445. ↑

**C888.** Jun-Yong Lee. Carbon nanotube based electrochemical immunosensors for high-sensitive detection of E. coli. / Jun-Yong Lee, Eun-Jin Park, Nam-Ki Min, Pak J.J., Cheol-Jin Lee, Min Ja Kim, Soo-Won Kim, Suk-In Hong. // 2009 IEEE Sensors. - Christchurch, 25-28 Oct. 2009. - P. 1176-1179. ↑

**C889.** Ahmad I. H $\infty$  controller design for high-performance scanning tunneling microscope. / Ahmad I., Voda A., Besancon G. // 2009 held jointly with the 2009 28th Chinese Control Conference. CDC/CCC 2009. Proceedings of the 48th IEEE Conference on Decision and Control. - Shanghai, 15-18 Dec. 2009. - P. 6058-6063. ↑

**C890.** Tejada A. Towards STEM control: Modeling framework and development of a sensor for defocus control. / Tejada A., Van den Broek W., van der Hoeven S.W., den Dekker A.J. // 2009 held jointly with the 2009 28th Chinese Control Conference. CDC/CCC 2009. Proceedings of the 48th IEEE Conference on Decision and Control. - Shanghai, 15-18 Dec. 2009. - P. 8310-8315. ↑

**C891.** Gondhalekar R. Model predictive control of linear periodic systems-a unified framework including control of multirate and multiplexed systems. / Gondhalekar R., Jones C.N. // 2009 held jointly with the 2009 28th Chinese Control Conference. CDC/CCC 2009. Proceedings of the 48th IEEE Conference on Decision and Control. - Shanghai, 15-18 Dec. 2009. - P. 6351-6358. ↑

**C892.** Oppermann M. X-ray computed tomography on miniaturized solder joints for nano packaging. / Oppermann M., Zerna T., Wolter K.-J. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 70-75. ↑

**C893.** Seok Hwan Lee. Dynamic visualizations of flow and meniscus for quadrilateral bump arrangement in capillary underfill process. / Seok Hwan Lee, Jaeyong Sung. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 215-219. ↑

**C894.** Chandra Rao B.S.S. Effect of strain rate and temperature on tensile flow behavior of SnAgCu nanocomposite solders. / Chandra Rao B.S.S., Mohan Kumar K., Zeng K.Y., Tay A.A.O., Kripesh V. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 272-277. ↑

**C895.** Wahsheh R.A. Compact nanoplasmonic Mach-Zehnder interferometers. / Wahsheh R.A., Zhaolin Lu, Abushagur M.A.G. // 2009 6th International Symposium on High-Capacity Optical Networks and Enabling Technologies (HONET). - Alexandria, 28-30 Dec. 2009. - P. 182-183. ↑

**C896.** Ang K.-W. Silicon photonics technologies for monolithic electronic-photonic integrated circuit (EPIC) applications: Current progress and future outlook. / Ang K.-W., Liow T.-Y., Fang Q., Yu M.B., Ren F.F., Zhu S.Y., Zhang J., Ng J.W., Song J.F., Xiong Y.Z., Lo G.Q., Kwong D.-L. // 2009 IEEE International Electron Devices Meeting (IEDM). - Baltimore, MD, 7-9 Dec. 2009. - P. 1-4. ↑

**C897.** Tseng-Fu Lua. A novel flash-ion-sensitive field-effect transistor (FISFET) with HfO<sub>2</sub>/Gd<sub>2</sub>O<sub>3</sub> (Gd) nano-crystal/SiO<sub>2</sub> sensing membranes under super nernstian phenomenon for pH and urea detection. / Tseng-Fu Lua, Jer-Chyi Wang, Chao-Sung Laia, Chia-Ming Yanga, Min-Hsien Wu, Chuan-Pu Liu, Rong-Shie Huang, Yu-Ching Fang. // 2009 IEEE International Electron Devices Meeting (IEDM). - Baltimore, MD, 7-9 Dec. 2009. - P. 1-4. ↑

**C898.** Afshar V.S. New frontiers in nano-scale highly nonlinear photonic circuits for System on System (SoS) Integration. / Afshar V.S., Wenqi Zhang, Ebendorff-Hejperime H., Eshraghian K., Monro T. // 2009 International SoC Design Conference (ISOCC). - Busan, 22-24 Nov. 2009. - P. 1-4. ↑

**C899.** Sasangka W.A. Effect of bonding and aging temperatures on bond strengths of Cu with 75Sn25In solders. / Sasangka W.A., Gan C.L., Thompson C.V., Choi W.K., Wei J. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 336-341. ↑

**C900.** Quintero J.A. Electro-mechanical evaluation of Ag trace patterns by ink-jet printing. / Quintero J.A., Mancosu R.D., de Oliveira A.W.C., Rolim D.C., da Silva O.C., Silva J.M. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 1000-1005. ↑



- C901.** Nakazawa M. A proposal of a method to analyze 3D deformation / fracture characteristics inside materials based on a stratified matching approach. / Nakazawa M., Kobayashi M., Toda H., Aoki Y. // 2009. IECON 09. 35th Annual Conference of IEEE Industrial Electronics. - Porto, 3-5 Nov. 2009. - P. 1979-1984. ↑
- C902.** Firouzi F. Analysis of single-event effects in embedded processors for non-uniform fault tolerant design. / Firouzi F., Salehi M.E., Azarpeyvand A., Fakhraie S.M., Safari S. // 2009. IIT '09. International Conference on Innovations in Information Technology. - Al Ain, 15-17 Dec. 2009. - P. 125-129. ↑
- C903.** Arafat M.M. Interfacial reaction and dissolution behavior of Cu substrate in molten Sn-3.8Ag-0.7Cu-nano Mo composite solder. / Arafat M.M., Haseeb A.S.M.A. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 953-956. ↑
- C904.** Cheng X. Intermetallics formation and evolution in pure indium joint for cryogenic application. / Cheng X., Liu C., Silberschmidt V.V. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 562-566. ↑
- C905.** Auersperg J. Crack and damage evaluation in low-k BEoL structures under CPI aspects. / Auersperg J., Vogel D., Lehr M.U., Grillberger M., Michel B. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 596-599. ↑
- C906.** Felba J. Properties of conductive microstructures containing nano sized silver particles. / Felba J., Nitsch K., Piasecki T., Tesarski S., Moscicki A., Kinart A., Bonfert D., Bock K. // 2009. EPTC 09. 11th Electronics Packaging Technology Conference. - Singapore, 9-11 Dec. 2009. - P. 879-883. ↑
- C907.** Ding H. Toward a Low Cost and Single Chip Holter: SoC-Holter. / Ding H., Hou K.M., Lecoq J., Zhou H., Sun H., Royer L., Bohner G., Ponsonnaille J., Murat N. // 2009 3rd International Conference on New Technologies, Mobility and Security (NTMS). - Cairo, 20-23 Dec. 2009. - P. 1-5. ↑
- C908.** Cho Hyungsuck. Optomechatronics: Challenges to smart integration of optical and mechatronic technologies with controllable and observable elements. 2009 ICCAS-SICE. - Fukuoka, Japan, 18-21 Aug. 2009. - P. xv. ↑
- C909.** D'Agostino C. An accurate approach for statistical estimation of leakage current considering multi-parameter process variations in nanometer CMOS technologies. / D'Agostino C., Le Coz J., Flatresse P., Beigne E., Belleville M. // 2009. ESSDERC 09. Proceedings of the European Solid State Device Research Conference. - Athens, 14-18 Sept. 2009. - P. 427-430. ↑
- C910.** Byungjoon Hwang. Comparison of double patterning technologies in NAND flash memory with sub-30nm node. / Byungjoon Hwang, Jeehoon Han, Myeong-Cheol Kim, Sunggon Jung, Namsu Lim, Sowi Jin, Yongsik Yim, Donghwa Kwak, Jaekwan Park, Jungdal Choi, Kinam Kim. // 2009. ESSDERC 09. Proceedings of the European Solid State Device Research Conference. - Athens, 14-18 Sept. 2009. - P. 269-271. ↑
- C911.** Toshio Fukuda. Measurement and control in micro-nano robotics and automation system. 2009 ICCAS-SICE. - Fukuoka, Japan, 18-21 Aug. 2009. - P. xiv. ↑
- C912.** Neizvestny I.G. Semiconductor nanowire sensors. 2009. INTERNANO 2009. International School and Seminar on Modern Problems of Nanoelectronics, Micro- and Nanosystem Technologies. - Novosibirsk, 28-31 Oct. 2009. - P. 3-8. ↑
- C913.** Seleznev V.A. Tubular micro- and nano- sensors and actuators for aerodynamics. / Seleznev V.A., Prinz V.Ya., Aniskin V.A., Shiplyuk A.N. // 2009. INTERNANO 2009. International School and Seminar on Modern Problems of Nanoelectronics, Micro- and Nanosystem Technologies. - Novosibirsk, 28-31 Oct. 2009. - P. 74-77. ↑
- C914.** Ono H. Novel control and peripheral technologies proposed for future hard disk drives. 2009 ICCAS-SICE. - Fukuoka, 18-21 Aug. 2009. - P. 1-6. ↑
- C915.** Shibata T. Bio-inspired devices, circuits and systems. 2009. ESSDERC 09. Proceedings of the European Solid State Device Research Conference. - Athens, 14-18 Sept. 2009. - P. 8-15. ↑
- C916.** Sung Man Cho. Development of 3-D shapes estimation by using single X-ray image. / Sung Man Cho, Hyuk-Hoon Shim, Jong-Hyeong Kim, Chun-Sam Song, Joon Hyun Kim, Won Jong Joo. // 2009. ISOT 2009. ↑



International Symposium on Optomechatronic Technologies. - Istanbul, 21-23 Sept. 2009. - P. 345-350. ↑

C917. Shibata T. Bio-inspired devices, circuits and systems. 2009. ESSCIRC 09. Proceedings of ESSCIRC. - Athens, 14-18 Sept. 2009. - P. 8-15. ↑

C918. Pereira M.M. Dynamically Adapted Low-Energy Fault Tolerant Processors. / Pereira M.M., Carro L. // 2009. AHS 2009. NASA/ESA Conference on Adaptive Hardware and Systems. - San Francisco, CA, July 29 2009-Aug. 1 2009. - P. 91-97. ↑

C919. Ghanbari A. Prediction of the behavior of a microcantilever based optomechatronic force sensor by finite element method. / Ghanbari A., Rostami A., Fakhrabadi M., Janabi-Sharifi F. // 2009. ISOT 2009. International Symposium on Optomechatronic Technologies. - Istanbul, 21-23 Sept. 2009. - P. 334-339. ↑

C920. Naseer M. Fault Tolerance in FPGA Architecture Using Hardware Controller-A Design Approach. / Naseer M., Sharma P., Kshirsagar R. // 2009. ARTCom '09. International Conference on Advances in Recent Technologies in Communication and Computing. - Kottayam, Kerala, 27-28 Oct. 2009. - P. 906-908. ↑

C921. Crespi A. Femtosecond laser fabrication of optical sensors integrated in a lab-on-a-chip. / Crespi A., Gu Y., Bellini N., Vishnubhatla K.C., Ramponi R., Osellame R., Cerullo G. // 2009. ISOT 2009. International Symposium on Optomechatronic Technologies. - Istanbul, 21-23 Sept. 2009. - P. 392-397. ↑

C922. Cheol Song. High-resolution high-speed spectral domain optical coherence tomography. / Cheol Song, MyoungKi Ahn, DaeGab Gweon, HyungSuck Cho. // 2009. ISOT 2009. International Symposium on Optomechatronic Technologies. - Istanbul, 21-23 Sept. 2009. - P. 11-15. ↑

C923. {no data available}. Title page. 2009. SMC 2009. IEEE International Conference on Systems, Man and Cybernetics. - San Antonio, TX, 11-14 Oct. 2009. - P. 1. ↑

C924. Selvaraja S.K. Effect of device density on the uniformity of silicon nano-photon waveguide devices. / Selvaraja S.K., De Vos K., Bogaerts W., Bienstman P., Van Thourhout D., Baets R. // 2009. LEOS '09. IEEE LEOS Annual Meeting Conference Proceedings. - Belek-Antalya, 4-8 Oct. 2009. - P. 311-312. ↑

C925. Chi-Chia Sun. VLSI circuit design concept for parallel iterative algorithms in nanoscale. / Chi-Chia Sun, Gotze J. // 2009. ISCIT 2009. 9th International Symposium on Communications and Information Technology. - Icheon, 28-30 Sept. 2009. - P. 688-692. ↑

C926. Safaric R. Micro and nano robotics. / Safaric R., Cas J., Skorc G., Protsenko S.I. // 2009. ICAT 2009. XXII International Symposium on Information, Communication and Automation Technologies. - Bosnia, 29-31 Oct. 2009. - P. 1-6. ↑

C927. Matsuzawa A. High speed and low power ADC design with dynamic analog circuits. 2009. ASICON '09. IEEE 8th International Conference on ASIC. - Changsha, Hunan, 20-23 Oct. 2009. - P. 218-221. ↑

C928. Lei He. Power-efficient and fault-tolerant circuits and systems. / Lei He, Yu Hu. // 2009. ASICON '09. IEEE 8th International Conference on ASIC. - Changsha, Hunan, 20-23 Oct. 2009. - P. 708-713. ↑

C929. Moore R. Can the regulatory framework cope with nano- and other converging technologies?. 2009 IET Bionic Health: Next Generation Implants, Prosthetics and Devices. - London, 1-1 Oct. 2009. - P. 1-25. ↑

C930. Pathak R. Energy modeling in carbon nano tube based wireless sensor networks. / Pathak R., Joshi S. // 2009. AH-ICI 2009. First Asian Himalayas International Conference on Internet. - Kathmandu, 3-5 Nov. 2009. - P. 1-3. ↑

C931. Fei Li. DNA computation model based on self-assembled nanoparticle probes for 0-1 integer programming problem. / Fei Li, Jingming Liu, Zheng Li. // 2009. BIC-TA '09. Fourth International Conference on Bio-Inspired Computing. - Beijing, 16-19 Oct. 2009. - P. 1-4. ↑

C932. Balestra F. SOI-a platform for transition from micro to nano. 2009. CAS 2009. International Semiconductor Conference. - Sinaia, 12-14 Oct. 2009. - Vol. 1. - P. 3-12. ↑

C933. Muller A. GHz FBAR and SAW resonators manufactured ON GaN/Si. / Muller A., Neculoiu D., Konstantinidis G., Vasilache D., Dinescu A., Stavriniadis A., Deligiorgis G., Danila M., Tzagaraki K., Cismaru A.,



Buiculescu C., Petrini I., Muller A.A., Dascalu D. // 2009. CAS 2009. International Semiconductor Conference. - Sinaia, 12-14 Oct. 2009. - Vol. 1. - P. 319-322. ↑

C934. Yu-Chung Hsiao. Efficient capacitance solver for 3D interconnect based on template-instantiated basis functions. / Yu-Chung Hsiao, El-Moselhy T., Daniel L. // 2009. EPEPS '09. IEEE 18th Conference on Electrical Performance of Electronic Packaging and Systems. - Portland, OR, 19-21 Oct. 2009. - P. 179-182. ↑

C935. Wunderle B. Progress in thermal characterisation methods and thermal interface technology within the "Nanopack" project. / Wunderle B., Ras M.A., Klein M., Mrossko R., Engelmann G., May D., Wittler O., Schacht R., Dietrich L., Oppermann H., Michel B. // 2009. THERMINIC 2009. 15th International Workshop on Thermal Investigations of ICs and Systems. - Leuven, 7-9 Oct. 2009. - P. 224-232. ↑

C936. Vasileska D. Electro-thermal modeling of nano-scale devices. / Vasileska D., Raleva K., Goodnick S.M. // 2009. THERMINIC 2009. 15th International Workshop on Thermal Investigations of ICs and Systems. - Leuven, 7-9 Oct. 2009. - P. 195-196. ↑

C937. Ziaei A. Presentation and status of the NANOPACK project. / Ziaei A., Demoustier S. // 2009. THERMINIC 2009. 15th International Workshop on Thermal Investigations of ICs and Systems. - Leuven, 7-9 Oct. 2009. - P. 192-194. ↑

C938. Beg A. Relating reliability to circuit topology. / Beg A., Ibrahim W. // 2009. NEWCAS-TAISA '09. Joint IEEE North-East Workshop on Circuits and Systems and TAISA Conference. - Toulouse, June 28 2009-July 1 2009. - P. 1-4. ↑

C939. Pfitzner A. DC characteristics of Junction Vertical Slit Field-Effect Transistor (JVeSFET). / Pfitzner A., Staniewski M., Strzyga M. // 2009. MIXDES '09. MIXDES-16th International Conference Mixed Design of Integrated Circuits & Systems. - Lodz, 25-27 June 2009. - P. 420-423. ↑

C940. Collet J.H. Comparison of fault-tolerance techniques for massively defective fine- and coarse-grained nanochips. / Collet J.H., Psarakis M., Zajac P., Gizopoulos D., Napieralski A. // 2009. MIXDES '09. MIXDES-16th International Conference Mixed Design of Integrated Circuits & Systems. - Lodz, 25-27 June 2009. - P. 23-30. ↑

C941. Ibrahim W. Why should we care about input vectors?. / Ibrahim W., Beiu V., Amer H. // 2009. NEWCAS-TAISA '09. Joint IEEE North-East Workshop on Circuits and Systems and TAISA Conference. - Toulouse, June 28 2009-July 1 2009. - P. 1-4. ↑

C942. Pashchenko A.G. Particles delocalization in nanostructures with complex energy profile under the action of external perturbation. 2009. CriMiCo 2009. 19th International Crimean Conference Microwave & Telecommunication Technology. - Sevastopol, 14-18 Sept. 2009. - P. 665-666. ↑

C943. Nakata Y. Generation of nano-structured surfaces by liquidly process induced by interfering femtosecond laser processing. / Nakata Y., Hiromoto T., Miyanaga N. // 2009. CLEO/PACIFIC RIM '09. Conference on Lasers & Electro Optics & The Pacific Rim Conference on Lasers and Electro-Optics. - Shanghai, 30-3 Aug. 2009. - P. 1-2. ↑

C944. Beiu V. On wires driven by a few electrons. / Beiu V., Ibrahim W., Makki R.Z. // 2009. NEWCAS-TAISA '09. Joint IEEE North-East Workshop on Circuits and Systems and TAISA Conference. - Toulouse, June 28 2009-July 1 2009. - P. 1-4. ↑

C945. Tang Yu-lan. An Improved Molecular Dynamics Algorithm for Large Scale Simulation in Nano-Engineering. / Tang Yu-lan, Chen Jia-xuan. // 2009. ICICTA '09. Second International Conference on Intelligent Computation Technology and Automation. - Changsha, Hunan, 10-11 Oct. 2009. - Vol. 2. - P. 841-844. ↑

C946. Xinxin Li. Cantilever sensors equipped with nano sensing effects for ultra-sensitive detection of bio/chemical molecules. 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 1620-1625. ↑

C947. Sidler K. Minimized blurring in stencil lithography using a compliant membrane. / Sidler K., Villanueva G., Vazquez-Mena O., Brugger J. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 1612-1615. ↑

C948. Myongjai Lee. Atomic layer deposition enabled interconnect technology for vertical nanowire array



devices. / Myongjai Lee, Jen-Hau Cheng, Bertness K., Sanford N., Seghete D., George S., Lee Y.C. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 2054-2057. ↑

C949. Jian Chen. pH-responsive drug-delivery devices for implantable applications. / Jian Chen, Chu M., Koulajian K., Xiao Yu Wu, Giacca A., Yu Sun. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 1465-1468. ↑

C950. Chan H.-Y. Implantable polycrystalline diamond neural probe for in vivo and in vitro physiological recording. / Chan H.-Y., Varney M., Hatch S., Aslam D.M. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 1202-1205. ↑

C951. Chiu Y. CMOS-MEMS knife-edge optical spot profiling system. / Chiu Y., Chang T.L., Pan C.H. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 1369-1372. ↑

C952. Ding F. Stress-assistant selective etching mechanism for lithography-independent nanofabrication. / Ding F., Ni C., Yu W.X., Li C., Wu W.G., Xu J. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 1317-1320. ↑

C953. DaiSik Kim. Terahertz nanoresonators: Control and measurements. 2009. IRMMW-THz 2009. 34th International Conference on Infrared, Millimeter, and Terahertz Waves. - Busan, 21-25 Sept. 2009. - P. 1-5. ↑

C954. Park H.R. Terahertz nanogap antenna for detection of nano-rods. / Park H.R., Seo M.A., Kyoung J.S., Kang J.H., Q-Han Park, Suwal O.K., Choi S.S., Koo S.M., Park N.K., Kim D.S. // 2009. IRMMW-THz 2009. 34th International Conference on Infrared, Millimeter, and Terahertz Waves. - Busan, 21-25 Sept. 2009. - P. 1-2. ↑

C955. Xiaowei Zhang. Improve the Portability of J2ME Applications: An Architecture-Driven Approach. / Xiaowei Zhang, Donggang Cao, Hong Mei. // 2009. MUE '09. Third International Conference on Multimedia and Ubiquitous Engineering. - Qingdao, 4-6 June 2009. - P. 386-391. ↑

C956. Hayashi H. Electrostatic Charging and Precipitation of Diesel Soot. / Hayashi H., Takasaki Y., Kawahara K., Takenaka T., Takashima K., Mizuno A., Moo Been Chang. // 2009. IAS 2009. IEEE Industry Applications Society Annual Meeting. - Houston, TX, 4-8 Oct. 2009. - P. 1-8. ↑

C957. Hida H. Micromachined tube-type of Si droplet generator. / Hida H., Inagaki N., Koyama M., Shikida M., Sato K. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 386-389. ↑

C958. Lee B.C. Microfabricated neural thermocouple arrays probe for brain research. / Lee B.C., Lim Y.-G., Kim K.-H., Lee S., Moon S. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 338-341. ↑

C959. de Rooij N.F. MEMS for space. / de Rooij N.F., Gautsch S., Briand D., Marxer C., Miletì G., Noell W., Shea H., Staufer U., van der Schoot B. // 2009. TRANSDUCERS 2009. International Solid-State Sensors, Actuators and Microsystems Conference. - Denver, CO, 21-25 June 2009. - P. 17-24. ↑

C960. Fournel F. From silicon direct wafer bonding to surface nano-patterning: a way to innovative substrate elaboration. / Fournel F., Bavard A., Eymery J. // 2009 IEEE International SOI Conference. - Foster City, CA, 5-8 Oct. 2009. - P. 1-4. ↑

C961. Dragoman M. RF devices written with carbon nanotube ink on paper. / Dragoman M., Dragoman D., Al Ahmad M., Plana R., Flahaut E. // 2009. EuMC 2009. European Microwave Conference. - Rome, Sept. 29 2009-Oct. 1 2009. - P. 575-577. ↑

C962. Torkhov N.A. Fractal geometry of reliefs and surface potentials in epitaxial gallium arsenide and barrier metallization. / Torkhov N.A., Bozhkov V.G., Novikov V.A., Ivonin I.V. // 2009. CriMiCo 2009. 19th International Crimean Conference Microwave & Telecommunication Technology. - Sevastopol, 14-18 Sept. 2009. - P. 550-551. ↑

C963. Mazinov A.S. Localized states of nanodimensional semiconductor structures. / Mazinov A.S., Bahov V.A., Nazderkin E.A. // 2009. CriMiCo 2009. 19th International Crimean Conference Microwave &



Telecommunication Technology. - Sevastopol, 14-18 Sept. 2009. - P. 623-624. ↑

C964. Makinen R. Application of Jacobi-Davidson algorithm to 2-D eigen-mode problems in printable electronics. / Makinen R., Sillanpaa H., Ostman K., Palukuru V., Pynttari V., Kanerva T., Hagberg J., Lepisto T., Jantunen H. // 2009. ICEAA '09. International Conference on Electromagnetics in Advanced Applications. - Torino, 14-18 Sept. 2009. - P. 122-125. ↑

C965. Parizi K.B. An internally amplified signal SOI nano-bridge biosensor for electrical detection of DNA hybridization. / Parizi K.B., Melosh N., Nishi Y. // 2009 IEEE International SOI Conference. - Foster City, CA, 5-8 Oct. 2009. - P. 1-2. ↑

C966. De Micheli G. Nano-tera.CH: Nano-technologies for tera-scale problems. 2009. BCTM 2009. IEEE Bipolar/BiCMOS Circuits and Technology Meeting. - Capri, 12-14 Oct. 2009. - P. 142-145. ↑

C967. Linhua Jiang. An Intelligent Peak Search Program for Digital Electron Diffraction Images of 3D Nano-Crystals. / Linhua Jiang, Georgieva D., IJspeert K., Abrahams J.P. // 2009. CISP '09. 2nd International Congress on Image and Signal Processing. - Tianjin, 17-19 Oct. 2009. - P. 1-5. ↑

C968. Pal P. Wet etched complex three dimensional MEMS structures. / Pal P., Sato K. // 2009. MHS 2009. International Symposium on Micro-NanoMechatronics and Human Science. - Nagoya, 9-11 Nov. 2009. - P. 553-558. ↑

C969. Hikita Masayuki. Partial discharge endurance test on several kinds of nano-filled enameled wires under high-frequency AC voltage simulating inverter surge voltage. / Hikita Masayuki, Yamaguchi Kouhei, Fujimoto Masato, Kozako Masahiro, Ohtsuka Shinya, Ohya Makoto, Tomizawa Keiichi, Fushimi Noriyoshi. // 2009. CEIDP 09. IEEE Conference on Electrical Insulation and Dielectric Phenomena. - Virginia Beach, VA, 18-21 Oct. 2009. - P. 719-722. ↑

C970. Iqbal Muddassir. Low refractive index contrast double slot structure based cantilever type sensor. / Iqbal Muddassir, Zheng Zheng, Liu Jiansheng. // 2009 Asia Communications and Photonics Conference and Exhibition (ACP). - Shanghai, China, 2-6 Nov. 2009. - P. 1-2. ↑

C971. Kim Myong-Ki. Laser sintering of the printed silver ink. / Kim Myong-Ki, Hwang Jun Young, Kang Heuiseok, Kang Kyungtae, Lee Sang-Ho, Moon Seung-Jae. // 2009. ISAM 2009. IEEE International Symposium on Assembly and Manufacturing. - Suwon, 17-20 Nov. 2009. - P. 155-158. ↑

C972. Sahu S. Remarkable potential of pattern based computing on an organic molecular layer using the concept of cellular automata. / Sahu S., Bandyopadhyay A., Fujita D. // 2009. ISPACS 2009. International Symposium on Intelligent Signal Processing and Communication Systems. - Kanazawa, 7-9 Jan. 2009. - P. 425-428. ↑

C973. Murakami Y. Space charge formation in low-density polyethylene up to breakdown influenced by addition of MgO nano-filler under DC ramp voltage. / Murakami Y., Okazaki T., Nagao M., Sekiguchi Y., Reddy C. C., Murata Y. // 2009. CEIDP 09. IEEE Conference on Electrical Insulation and Dielectric Phenomena. - Virginia Beach, VA, 18-21 Oct. 2009. - P. 685-688. ↑

C974. Wessling B. Nanotechnology for lead-free PWB final finishes with the Organic Metal. / Wessling B., Kenny J. // 2009. IMPACT 2009. 4th International Microsystems, Packaging, Assembly and Circuits Technology Conference. - Taipei, 21-23 Oct. 2009. - P. 554-557. ↑

C975. Shang-Chou Chang. Carbon nano tubes grown on glass substrate with different interface layer. / Shang-Chou Chang, To-Sing Li, Tien-Chai Lin, Jian-Hua Lee. // 2009. IMPACT 2009. 4th International Microsystems, Packaging, Assembly and Circuits Technology Conference. - Taipei, 21-23 Oct. 2009. - P. 561-564. ↑

C976. Pathak Rohit. Multi-scale Modeling for Nano Scale Phenomenon Using CUDA Based Framework. / Pathak Rohit, Joshi Satyadhar. // 2009. ACT '09. International Conference on Advances in Computing, Control, & Telecommunication Technologies. - Trivandrum, Kerala, 28-29 Dec. 2009. - P. 278-283. ↑

C977. Mattausch H.J. Keynote 1: The Role of Functional Memories in Parallel Information Processing with Localized and Distributed Systems. / Mattausch H.J., Johguchi K., Kumaki T., Koide T. // 2009 International Conference on Parallel and Distributed Computing, Applications and Technologies. - Higashi Hiroshima, 8-11 Dec. 2009. - P. xxiii. ↑



**C978.** Bunyatova F.K. Digital school. / Bunyatova F.K., Bunyatova A. // 2009. AICT 2009. International Conference on Application of Information and Communication Technologies. - Baku, 14-16 Oct. 2009. - P. 1-5.



**C979.** Sheng Lin. A Novel Hardened Design of a CMOS Memory Cell at 32nm. / Sheng Lin, Yong-Bin Kim, Lombardi F. // 2009. DFT 09. 24th IEEE International Symposium on Defect and Fault Tolerance in VLSI Systems. - Chicago, IL, 7-9 Oct. 2009. - P. 58-64.



**C980.** Yong-Lai Tian. Microwave based technique for ultra-fast and ultra-high temperature thermal processing of compound semiconductors and nano-scale Si semiconductors. 2009. RTP 09. 17th International Conference on Advanced Thermal Processing of Semiconductors. - Albany, NY, Sept. 29 2009-Oct. 2 2009. - P. 1-5.



**C981.** Wangyuan Zhang. Characterizing and mitigating the impact of process variations on phase change based memory systems. / Wangyuan Zhang, Tao Li. // 2009. MICRO-42. 42nd Annual IEEE/ACM International Symposium on Microarchitecture. - New York, NY, 12-16 Dec. 2009. - P. 2-13.



**C982.** Vavrinsky E. Micro- / nano- structuralized interfaces of conductive and transparent thin-film microelectrodes for biomedical application. / Vavrinsky E., Flickyngeroval S., Gaspierik P., Skrinariova J., Novotny I., Stopjakova V., Viglasky R., Tvarozek V., Sutta P. // 2009. ISABEL 2009. 2nd International Symposium on Applied Sciences in Biomedical and Communication Technologies. - Bratislava, 24-27 Nov. 2009. - P. 1-6.



**C983.** Zimmermann L. A novel fabrication method to integrate super hydrophobic nanostructures into microfluidic systems. / Zimmermann L., Guttman M., Guber A., Saile V. // 2009. ISABEL 2009. 2nd International Symposium on Applied Sciences in Biomedical and Communication Technologies. - Bratislava, 24-27 Nov. 2009. - P. 1-5.



**C984.** Yamada T. Proposal of heavily doped silicon between insulators MOSFETs and confirmation of their advantages by device simulation. / Yamada T., Miyazawa Y., Nakajima Y., Hanajiri T., Toyabe T., Sugano T. // 2009. ISDRS '09. International Semiconductor Device Research Symposium. - College Park, MD, 9-11 Dec. 2009. - P. 1-2.



**C985.** Fregonese S. A versatile compact model for ballistic 1D transistor: Applications to GNR-FET and CNT-FET. / Fregonese S., Maneux C., Zimmer T. // 2009. ISDRS '09. International Semiconductor Device Research Symposium. - College Park, MD, 9-11 Dec. 2009. - P. 1-2.



**C986.** Nakajima Y. Correlation between high-density trap states and local stress near SOI/BOX interface in SIMOX wafers. / Nakajima Y., Watanabe Y., Hanajiri T., Toyabe T., Sugano T. // 2009. ISDRS '09. International Semiconductor Device Research Symposium. - College Park, MD, 9-11 Dec. 2009. - P. 1-2.



**C987.** Abdelmoneum M. Micro and Nano Electro Mechanical Systems (MEMS/NEMS) for Mobile Computing Systems. / Abdelmoneum M., Browning D., Arabi T., Khalil Waleed. // 2009 IEEE 70th Vehicular Technology Conference Fall (VTC 2009-Fall). - Anchorage, AK, 20-23 Sept. 2009. - P. 1-4.



**C988.** Chih-Chun Teng. Preparation and characterization of nano-inorganic materials coated multi-walled carbon nanotubes/epoxy composites for thermal interface materials. / Chih-Chun Teng, Ma C.-C.M., Shin-Yi Yang, Yen-Wei Huang, Kuo-Chan Chiou, Tzong-Ming Lee, Wei-Syuan He, Jen-Chi Chuiang. // 2009. IMPACT 2009. 4th International Microsystems, Packaging, Assembly and Circuits Technology Conference. - Taipei, 21-23 Oct. 2009. - P. 469-472.



**C989.** Mochizuki M. Thermal management in high performance computers by use of heat Pipes and vapor chambers, and the challenges of global warming and environment. / Mochizuki M., Nguyen T., Mashiko K., Saito Y., Xiao Ping Wu, Wuttijumnong V. // 2009. IMPACT 2009. 4th International Microsystems, Packaging, Assembly and Circuits Technology Conference. - Taipei, 21-23 Oct. 2009. - P. 191-194.



**C990.** Nathan Arokia. Call for papers second international workshop on compact thin-film transistor (TFT) modeling for circuit simulation. / Nathan Arokia, Milne Bill, Migliorato Piero, De Souza Maria Merlyne, Iniguez Benjamin, Fruehauf Norbert, Saha Samar, Deen Jamal, Chaji Reza, Kuo James B., Kim Hyun Jae, Xing Zhou. // 2009. TFT/CTFT '09. Compact Thin-Film Transistor Modeling for Circuit Simulation. - London, United Kingdom, 25-25 Sept. 2009. - P. 1.



**C991.** Diebold A.C. The ITRS metrology roadmap. 2009. ISDRS '09. International Semiconductor Device Research Symposium. - College Park, MD, 9-11 Dec. 2009. - P. 1-2.





- C992.** Kochetov R. Thermal conductivity of nano-filled epoxy systems. / Kochetov R., Andritsch T., Lafont U., Morshuis P.H.F., Smit J.J. // 2009. CEIDP 09. IEEE Conference on Electrical Insulation and Dielectric Phenomena. - Virginia Beach, VA, 18-21 Oct. 2009. - P. 658-661. ↑
- C993.** Ma Bin. Dielectric properties and resistance to corona and ozone of epoxy compositions filled with micro- and nano-fillers. / Ma Bin, Gubanski Stanislaw M., Krivda Andrej, Schmidt Lars E., Hollertz Rebecca. // 2009. CEIDP 09. IEEE Conference on Electrical Insulation and Dielectric Phenomena. - Virginia Beach, VA, 18-21 Oct. 2009. - P. 672-677. ↑
- C994.** Andritsch T. Synthesis and dielectric properties of epoxy based nanocomposites. / Andritsch T., Kochetov R., Gebrekiros Y.T., Lafont U., Morshuis P.H.F., Smit J.J. // 2009. CEIDP 09. IEEE Conference on Electrical Insulation and Dielectric Phenomena. - Virginia Beach, VA, 18-21 Oct. 2009. - P. 523-526. ↑
- C995.** Yoshida J. Space charge accumulation and breakdown in LDPE and LDPE/MgO nano-composite under high dc stress at various temperatures. / Yoshida J., Maezawa T., Miyake H., Tanaka Y., Takada T., Sekiguchi Y., Murata Y., Reddy C.C. // 2009. CEIDP 09. IEEE Conference on Electrical Insulation and Dielectric Phenomena. - Virginia Beach, VA, 18-21 Oct. 2009. - P. 150-153. ↑
- C996.** Seungjae Jung. Resistive switching characteristics of solution-processible TiOx using nano-scale via-hole structures. / Seungjae Jung, Tae-Wook Kim, Hyejung Choi, Jaemin Kong, Ju-Bong Park, Minseok Jo, Seonghyun Kim, Wootae Lee, Joonmyoung Lee, Takhee Lee, Kwanghee Lee, Hyunsang Hwang. // 2009. ISDRS '09. International Semiconductor Device Research Symposium. - College Park, MD, 9-11 Dec. 2009. - P. 1-2. ↑
- C997.** Mei Xue. A nano-scale molecular rotor device for high density memory application. / Mei Xue, Kabehie S., Stieg A., Tkatchouk E., Benitez D., Goddard W., Zink J.I., Wang K.L. // 2009. ISDRS '09. International Semiconductor Device Research Symposium. - College Park, MD, 9-11 Dec. 2009. - P. 1-2. ↑
- C998.** Okazaki T. Electric characteristics of MgO/LDPE nanocomposite up to breakdown under DC ramp voltage. / Okazaki T., Okuzumi S., Imazawa S., Murakami Y., Nagao M., Sekiguchi Y., Reddy C. C., Murata Y. // 2009. CEIDP 09. IEEE Conference on Electrical Insulation and Dielectric Phenomena. - Virginia Beach, VA, 18-21 Oct. 2009. - P. 654-657. ↑
- C999.** Xiaojun Ma. Errors in DNA Self-Assembly by Synthesized Tile Sets. / Xiaojun Ma, Hashempour M., Yong-Bin Kim, Lombardi F. // 2009. DFT 09. 24th IEEE International Symposium on Defect and Fault Tolerance in VLSI Systems. - Chicago, IL, 7-9 Oct. 2009. - P. 112-120. ↑
- C1000.** Shahidi G.G. Device scaling for 15 nm node and beyond. 2009. DRC 2009 Device Research Conference. - University Park, PA, 22-24 June 2009. - P. 247-250. ↑
- C1001.** Xulong Tang. Affect of Pressure on Photoreduction of CO2 to Acetaldehyde in Aqueous Suspensions of TiO2. / Xulong Tang, Guangjin Chen, Haili Liu, Jing Fang. // 2009. ICEET '09. International Conference on Energy and Environment Technology. - Guilin, Guangxi, 16-18 Oct. 2009. - Vol. 3. - P. 181-184. ↑
- C1002.** Yang Li. Yeast-Directed Hydrothermal Synthesis of ZnMoO4 Hollow Microspheres and Its Photocatalytic Degradation of Auramine O. / Yang Li, Guan Weisheng, Bai Bo, Guo Kaijie. // 2009. ICEET '09. International Conference on Energy and Environment Technology. - Guilin, Guangxi, 16-18 Oct. 2009. - Vol. 3. - P. 672-675. ↑
- C1003.** Schmidt J.C. Knowledge politics of nano-interdisciplinarity. 2009 Atlanta Conference on Science and Innovation Policy. - Atlanta, GA, 2-3 Oct. 2009. - P. 1-9. ↑
- C1004.** Lu Huang. A systematic technology forecasting approach for New and Emerging Science and Technology: Case study of nano-enhanced biosensors. / Lu Huang, Ying Guo, Porter A.L. // 2009 Atlanta Conference on Science and Innovation Policy. - Atlanta, GA, 2-3 Oct. 2009. - P. 1-10. ↑
- C1005.** Zhan Yang. Assembly of functional nanodevice using platinum/ tungsten nanowire. / Zhan Yang, Nakajima M., Fukuda T. // 2009. MHS 2009. International Symposium on Micro-NanoMechatronics and Human Science. - Nagoya, 9-11 Nov. 2009. - P. 237-242. ↑
- C1006.** Fang Yi. Research on conductive performance of inkjet printing samples by conductive inkjet ink. / Fang Yi, Li Luhai, Xin Zhiqing, Zhao Wen. // 2009 3rd IEEE International Symposium on Microwave, Antenna, Propagation and EMC Technologies for Wireless Communications. - Beijing, 27-29 Oct. 2009. - P. 63-66. ↑



- C1007.** Tiwari N. WsVsSenNet: An Era of Enhanced Vision Based Sensing Capability. / Tiwari N., Saraf J., Jain S. // 2009. ICCTD '09. International Conference on Computer Technology and Development. - Kota Kinabalu, 13-15 Nov. 2009. - Vol. 1. - P. 383-387. ↑
- C1008.** Hamdioui S. Testing Embedded Memories in the Nano-Era: Will the Existing Approaches Survive?. 2009. ATS 09. Asian Test Symposium. - Taichung, 23-26 Nov. 2009. - P. 339. ↑
- C1009.** Benabboud Y. Delay Fault Diagnosis in Sequential Circuits. / Benabboud Y., Bosio A., Dilillo L., Girard P., Pravossoudovitch S., Virazel A., Riewer O. // 2009. ATS 09. Asian Test Symposium. - Taichung, 23-26 Nov. 2009. - P. 355-360. ↑
- C1010.** Radzuan R. Realization assessment of stabilizer with presonation on size-distribution of itraconazole nanoparticulate in wet-nanomilling. / Radzuan R., Abdul Majeed A.B., Julianto T., Hamzah M.K., Hamzah N.R., Bukhari N.I. // 2009. ISIEA 2009. IEEE Symposium on Industrial Electronics & Applications. - Kuala Lumpur, 4-6 Oct. 2009. - Vol. 1. - P. 436-441. ↑
- C1011.** Jianfen Li. Hydrogen-Rich Gas Production from Steam Gasification of Palm Oil Wastes Using the Supported Nano-NiO/?-Al<sub>2</sub>O<sub>3</sub> Catalyst. / Jianfen Li, Yanfang Yin, Jianjun Liu, Rong Yan. // 2009. ICEET '09. International Conference on Energy and Environment Technology. - Guilin, Guangxi, 16-18 Oct. 2009. - Vol. 1. - P. 185-189. ↑
- C1012.** Weikang Qian. The synthesis of combinational logic to generate probabilities. / Weikang Qian, Riedel M.D., Bazargan K., Lilja D.J. // 2009. ICCAD 2009. IEEE/ACM International Conference on Computer-Aided Design-Digest of Technical Papers. - San Jose, CA, 2-5 Nov. 2009. - P. 367-374. ↑
- C1013.** Yajing Shen. In-situ single cell manipulation via nanorobotic manipulation system inside E-SEM. / Yajing Shen, Nakajima M., Ahmad M.R., Kojima S., Homma M., Fukuda T. // 2009. MHS 2009. International Symposium on Micro-NanoMechatronics and Human Science. - Nagoya, 9-11 Nov. 2009. - P. 432-437. ↑
- C1014.** Takamatsu R. Development of biodegradable scaffolds by leaching self-assembled magnetic sugar particles. / Takamatsu R., Oura H., Uchida T., Ikeda S., Arai F., Negoro M., Hayakawa M., Takahashi I., Fukuda T. // 2009. MHS 2009. International Symposium on Micro-NanoMechatronics and Human Science. - Nagoya, 9-11 Nov. 2009. - P. 356-361. ↑
- C1015.** Stanisavljevic M. Optimization of Nanoelectronic Systems Reliability Under Massive Defect Density Using Distributed R-fold Modular Redundancy (DRMR). / Stanisavljevic M., Schmid A., Leblebici Y. // 2009. DFT 09. 24th IEEE International Symposium on Defect and Fault Tolerance in VLSI Systems. - Chicago, IL, 7-9 Oct. 2009. - P. 340-348. ↑
- C1016.** Hiseni S. A compact, nano-power CMOS action potential detector. / Hiseni S., Sawigun C., Ngamkham W., Serdijn W.A. // 2009. BioCAS 2009. IEEE Biomedical Circuits and Systems Conference. - Beijing, 26-28 Nov. 2009. - P. 97-100. ↑
- C1017.** Yehua Su. Defect-Tolerant Logic Mapping on Nanoscale Crossbar Architectures and Yield Analysis. / Yehua Su, Wenjing Rao. // 2009. DFT 09. 24th IEEE International Symposium on Defect and Fault Tolerance in VLSI Systems. - Chicago, IL, 7-9 Oct. 2009. - P. 322-330. ↑
- C1018.** Hao Zhuang. A Web-Based Platform for Nanoscale Non-classical Device Modeling and Circuit Performance Simulation. / Hao Zhuang, He F., Xinnan Lin, Lining Zhang, Jian Zhang, Xiufang Zhang, Mansun Chan. // 2009. WISM 2009. International Conference on Web Information Systems and Mining. - Shanghai, 7-8 Nov. 2009. - P. 371-375. ↑
- C1019.** Nakajima M. Local stiffness evaluation for alive C. elegans by Environmental-SEM nanorobotic manipulation system. / Nakajima M., Ahmad M.R., Kojima M., Kojima S., Homma M., Fukuda T. // 2009. MHS 2009. International Symposium on Micro-NanoMechatronics and Human Science. - Nagoya, 9-11 Nov. 2009. - P. 638-643. ↑
- C1020.** Rahman M.A.U. Efficient 2DMesh Network on Chip (NoC) Considering GALS Approach. / Rahman M.A.U., Ahmed I., Rodriguez F., Islam N. // 2009. ICCIT '09. Fourth International Conference on Computer Sciences and Convergence Information Technology. - Seoul, 24-26 Nov. 2009. - P. 841-846. ↑



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