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ТЕМАТИЧЕСКИЙ РЕФЕРАТИВНЫЙ СБОРНИК № 11-2

“Nanostructure”
(«Наноструктуры»)

Публикации в трудах конференций

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"Plasmonic nanostructure embedded within photoactive layer for enhanced power conversion efficiency of organic solar cells"

Gold quantum dots have been successfully embedded into the photoactive layer of a P3HT:C60 bilayer solar cell. I-V and EQE measurements confirm that the demonstrated bilayer device shows a 67% increase in conversion efficiency. [C1]

"Preparation and Characterization of Anatase Mesoporous TiO2 Particles Using Ionic Liquids as Template Solvents for Photocatalysis"

Synthesis of mesoporous TiO2particles using ionic liquid (IL)-assisted sol-gel method was investigated. The product was analyzed and characterized by X-ray diffraction (XRD), Transmission electron microscope (TEM), and N2adsorption and desorption. The products revealed higher photo catalytic activities than that of the commercially available TiO2, Degussa P25 in the photo degradation of methylene Blue. [C2]

"Photothermal nanoblade for single cell surgery"

We report a photothermal nanoblade that utilizes a metallic nanostructure to harvest short laser pulse energy and convert it into a highly localized and specifically shaped explosive vapor bubble. Rapid bubble expansion and collapse punctures a lightly-contacting cell membrane via high-speed fluidic flows and induced transient shear stress. The membrane cutting pattern is controlled by the metallic nanostructure configuration, laser pulse polarization, and energy. Highly controllable, sub-micron sized circular hole pairs to half moon-like, or cat-door shaped, membrane cuts were realized in glutaraldehyde treated HeLa cells. [C3]

"Selective self-assembly of nanoparticles on trench sidewalls and its relationship with scallop nanostructure"

Self-assembly of colloidal particles has an advantage of low cost, high productivity and applicability to various devices. The capability of assembling nano-scale particles on three dimensional structures can extend the fields of application, such as high-sensitivity gas sensors and bioassay devices with surface-functionalized particles. We demonstrate such assembly where monolayer polystyrene particles were assembled only on the sidewall of trenches etched on a silicon wafer. Moreover, it was found that the assembly structure can be controlled by the scallops when its periodicity is nearly the same as the particle diameter. [C4]

"Development of water-soluble sono/photo-sensitive nanopartices for cancer treatment"

Sonodyanmic Therapy (SDT) is a new type of cancer therapy and has attracted lots of research attention recently. In this article, we present how nano-formulation helped SL052 to form a water soluble sono/photo-sensitize nanoparticle (SL052-NPs) for cancer treatment. The nanostructure formation encapsulates SL052 and greatly improves the SL052 physicochemical properties without modifying its chemical structure. Nano-formulation also helps SL052 to achieve deep-site cancer delivery, image function for diagnosis, and ultrasound or photo controlled localized cancer therapy. [C5]

"Multifunctional discharge system for low temperature formation of carbon nanostructures"

In Institute of Metal Physics the plant for ionic-plasma formation carbon nanotubes and other nanostructures is created. The plant contains high-vacuum-pump system, working gases letting system, helicon discharge chamber, drift chamber, vacuum-arc sources, power sources and monitoring system with a small-sized optical spectrometer. The plant integrates processes plasma-enhanced chemical vapour-phase deposition, plasma clearing and activation of a substrate surface, deposition of transitive adhesive layers and metal-catalyst, direct formation process of carbon nanostructure. [C6]

"Nanostructure antennas for the LW-IR regime"

We review our previous work demonstrating planar dipole antenna structures which operate in the LW-IR regime (30 THz). Integrated metal-oxide-metal tunnel diodes are used as the rectifying element. These nanoantenna structures exhibit a polarization and length dependence expected from classical dipole antennas. We measure specific detectivities of 2*106cmHz1/2W-1. One way of increasing the detectivity of these antenna structures, which currently are fabricated on top of a silicon-silicon dioxide structure, is to place them on top of a cavity filled with a low-k dielectric to achieve higher antenna gain. We have explored the performance of cavity-backed dipoles for LW-IR operation by numerical simulations, and have experimentally verified the performance of these structures with a 1000-x scale model operating in Ka-band (30 GHz). [C7]

"Equipment design and process control of critical dimensions in lithography"

The lithography sequence is the most critical step in the fabrication of nanostructures for integrated circuit manufacturing. In this paper, we present the development of in-situ real-time sensors and actuating sytems for real-time monitoring and control of the single most critical parameter in the lithography sequence: the critical dimension (CD) or linewidth of the structures. The use of an in-situ non-destructive technique also ensures that wafer contamination during production is minimal. A spectroscopic ellipsometer is developed to monitor these nanostructures during their formation in-situ and in real-time. Coupled with the development of a programmable multizone thermal processing system, we demonstrated that these nanostructures can be manipulated in real-time during processing. This is an significant improvement to current monitoring and control techniques which are typically run-to-run or wafer-to-wafer; features are measured off-line and equipment setpoints adjusted for the next batch of wafers. [C8]

"Microwave properties of high-temperature superconducting YBCO(BZO) thin films with admixture nano-particles"

It was shown that addition of an admixture phase BZO (or any other dielectric phase, e.g., BaSnO3(BSO) or Y2O3) to "pure" YBCO thin films creates an additional defect nanostructure within the films. This is in agreement with similar results of other research groups (see, e.g., Ref [8]). This defect nanostructure is formed by nano-sized particles of admixture phase, which play the role of strong point-like pinning centers for Abrikosov vortices, as well as columnar defects, which in turn result from the self-organization of the nanoparticles into linear structures (directed primarily along the c axis) and additional dislocations in the film material, generated by these nanoparticles. [C9]

"Electron transfer between quasi-zero-dimensional nanostructures"

The electric charge transport is an important phenomenon in the systems like interacting quantum dots and molecules, and in polymers, including DNA molecules. We expect that in these nanostructure systems the key role is played by the interaction of the charge carriers with the optical phonons. We show the role of the multiple scattering of the charge carriers on the optical phonons in the inter-molecular transfer. The charge carrier transport based on this mechanism will be discussed theoretically and compared with the earlier experimental results on the charge transport in molecular Donor-Acceptor charge transfer crystals and also in other systems. In order to treat theoretically the electron transfer between two zero-dimensional nanostructures, we will use for simplicity the model of two interacting quantum dots coupled by the electron inter-dot tunneling mechanism. A connection with the popular Marcus semiclassical charge transfer theory, between two quasi-zero-dimensional reactants in chemistry, is also shown. We will use the nonequilibrium quantum electronic transport theory based on the nonequilibrium Green's functions. [C10]

"Metal nanoisland films for the enhancement of the chemico-physical properties of molecular adsorbates"

This contribution is aimed at describing the most recent activity carried out in the labs of ISC-CNR Florence concerning preparation and spectroscopic investigation of two dimensional silver and gold metal nanostructures (metal nanoisland films-MeNIFs), with particular focus on the role played by the morphology of the metal dielectric interfaces on the control and enhancement of the properties of different molecular adsorbates, i.e. fluorescence emission and Raman response. In particular, it shows how the fabrication procedure of Au nanoisland films permits fine tuning of the extinction spectrum of the nanostructures and controlled enhancement of the Raman response of a novel thiol-functionalized fluorophore. [C11]

"Delay of the wave in a magnetoactive periodic nanostructure dielectric-semiconductor"

Magnetoactive periodic nanostructure dielectric-semiconductor were theoretically studied. The delay of the waves in the structure were calculated by dispersive equation. Crystal lattice, tensor components permittivities, Voigt permittivity, electromagnetic wave, surface plasmon, plasma, collisions and cyclotron frequencies were calculated for semiconductor material n-InSb at 77 K with 100nm and 200 nm in thickness.. [C12]

"Ultrafast pulsation of fiber lasers by carbon nanostructures"

We demonstrate dramatically improved efficiency of carbon nanotube deposition for fiber pulsed lasers in high power regime employing elecrospray process. Passive laser pulsation by multi-layered graphene is also demonstrated with evanescent field interaction scheme. [C13]

"Time-domain optical response function reconstruction of an individual plasmonic nanostructure"

The precise characterization of the ultrafast electronic response in a metallic nanostructure is achieved using a combination of spectrogram measurement of collinear interferometric second-harmonic scattering and treatment of Frequency Resolved Optical Gating (FROG). The plasmon dephasing dynamics have been resolved with multiple time-scales. [C14]

"Manipulation of form birefringence in isotropic material"

Form-birefringent nanostructure composed of the self-organized oxygen defects can be created by light pulses with a width of 70 fs. Such rewritable and directionally controllable nanostructures have evolved by lowering threshold for defect formation. [C15]

"Micro- and nanostructure induced birefringence in phosphate glass fibers"

We demonstrate that microstructures inside the cladding of phosphate fiber as well as sub-wavelength nanostructures inside the fiber core can introduce birefringence in phosphate glass fiber components. [C16]

"Multi-wavelength femtosecond pump-probe characterization of 1550 nm InAs/InP quantum dash optical amplifiers"

We report the first multi wavelength, ultra fast pump probe characterization of an inhomogeneous broadened, nanostructure gain media. We identify different physical mechanisms that govern the dynamics at the different energies. [C17]

"Ultrafast hot electron relaxation in a metal nanostructure detected by femtosecond-SNOM"

Ultrahigh spatiotemporal resolved pump-probe signal on a metal nanostructure is detected by femtosecond-SNOM. By using two-color pump-probe configuration, ultrafast hot electron transportation is clearly observed on a time scale of a few hundred femtoseconds. [C18]

"Transmission SPR of Gold Nanoslit Array and Ultrasensitive Detection of a Retinol Binding Protein"

Retinal-modified SAM-coated nanoslit array thin gold film was used for ultra-sensitive (picomolar) detection of a ligand protein (β-Lactoglobulin) with a transmission SPR mode. The transmission spectra of nanoslit arrays with varying periods were evaluated for nanostructure optimization with respect to primary peak position, shape and sensitivity. Sensitivity of this method, as measured in water, was estimated at 3 ng/mL, or approximately 130 picomolar. Additionally a monotonic shift in primary peak wavelength was observed with changing nanoslit periodicity. This type of in-plane nanoarray chip is currently being integrated with microfluidic platforms for chemical and/or biological sensing applications. [C19]

"Nanostructure antennas for the LW-IR regime"

We review our previous work demonstrating planar dipole antenna structures which operate in the LW-IR regime (30 THz). Integrated metal-oxide-metal tunnel diodes are used as the rectifying element. These nanoantenna structures exhibit a polarization and length dependence expected from classical dipole antennas. We measure specific detectivities of 2*106 cmHz1/2W-1. One way of increasing the detectivity of these antenna structures, which currently are fabricated on top of a silicon-silicon dioxide structure, is to place them on top of a cavity filled with a low-k dielectric to achieve higher antenna gain. We have explored the performance of cavity-backed dipoles for LW-IR operation by numerical simulations, and have experimentally verified the performance of these structures with a 1000-x scale model operating in Ka-band (30 GHz). [C20]

"Nanoimprinted SU-8 Nanopillars and Hierarchically Branched Nanowires by Anodic Aluminum Oxide Templates and Their Optical Properties"

We fabricated well-dispersed SU-8 nanopillars and hierarchically branched nanowires using nanoimprinted method. Anodic aluminum oxide (AAO) templates with branched pore structures were used as templates. We successfully fabricated high density, large aspect ratio, large area SU-8 patterns. It provides a convenient and powerful approach to produce complicated nanostructures on SU-8 photoresist. The optical reflectivity was measured to characterize the SU-8 surface. Unique optical properties could be observed from these SU-8 nanopillar structures. [C21]

"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. [C22]

"Microwave method for contactless determination of charge carrier concentration and Hall resistance in semiconductor nanostructures"

A microwave method is developed to enable the oscillations of power due to the Shubnikov-de Haas effect to be measured in the microwave wave reflected from a sample. On the basis of these data, the charge carrier concentration and Hall-resistance in low-dimensional semiconductor systems containing degenerate electron gas localized within a -100 thick layer can be determined with an accuracy of ~0.5%. [C23]

"High-energy pulse formation using graphene as saturable absorber"

We demonstrate fiber pulsed lasers passively mode-locked by graphene in high-power regime. We realize an evanescent field interaction to form picosecond pulses with 21.41-dBm intracavity power escaping from the thermal damage of the carbon nanostructure. [C24]

"Table of contents"

The following topics are dealt with: microstructure; nanostructure; radio system; television system; radiolocation; telecommunications; sonic device; ultrasonic device; physics; electronics; optical device; thermal device; power electronics; mechatronics; and automation. [C25]

"Surface-enhanced Raman scattering by GaN and ZnO nanostructures"

Surface enhanced Raman scattering is studied in nanostructures with GaN and ZnO nanocolumns. Features related to optical phonons of nanocolumns are observed in the Raman spectra of both free-standing GaN and ZnO nanostructures. Strong enhancement of the Raman scattering intensity by surface optical phonons in GaN and ZnO nanocolumns is observed by deposition of silver clusters onto the nanostructure surfaces. [C26]

"Nanostructure optic-fiber-based devices for optical signal processing"

This paper presents an overview of our recent work on the nanostructure optic-fiber and devices for optical signal processing. The most fundamental devices, nano-fiber based coupler and microring, are studied as examples. Experimental results show good agreement with theoretical analysis. A possible packaging method is proposed. [C27]

"Influence of growth conditions on morphology of ZnO nanostructures in CVD process"

The effects of growth conditions on the morphology of ZnO nanostructures grown by CVD process with Au catalyst were systemically studied and the key factors controlling growth were identified. Two growth modes of ZnO formation were observed: self-catalyzed growth on Si substrate and gas-phase nucleation and growth. In the former case, the ZnO nanostructures grow by the vapor-solid mechanism and the morphology is very sensitive to the growth conditions. The partial pressure of zinc vapor determines the prevailing growth morphology. On the other hand, for the second mode, tetragonal nanowires are nucleated and their length increase with growth temperature. [C28]

"Molecular dynamics simulation on LO phonon mode decay in Si nano-structure covered with oxide films"

A series of molecular dynamics (MD) simulations is conducted to investigate the dynamics of longitudinal optical (LO) phonon in Si nano-structure confined with oxide films. This work is motivated by heat issues in nanoscopic devices; it is considered that the LO phonons with low group velocity are accumulated in the nanoscopic device and the electric property deteriorates. We estimate the relaxation time of the LO phonon and investigate its dependency on the oxide thickness. The calculation results show that the LO phonon decays faster as the oxide thickness increases and turns into acoustic phonon. The result indicates that the presence of SiO2films promotes the scattering of the phonon and this is effective to diminish the optical phonon. [C29]

"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 EFTE 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. [C30]

"Deposition of Pd nanoparticles on ultrathin Al2 O3 films"

It is widely accepted that self-assembling nanostructure of metals with well-defined spatial order is one of the promising ways for engineering new materials. Recent years revealed substantial progress in fabricating metal nanoparticles on ultrathin oxide films due to their ordered surface. In this work, we present the results on the adsorption of Pd nanoparticles on the ultrathin Al2O3films prepared on the Ni3Al(111) substrate. The thermal stability of the Pd nanoparticles has been studied. The results showed that the Pd nanoparticles with size of about 4 nm are stable at 580 K, but aggregation of the Pd nanoparticles was found at 730 K. [C31]

"Structural and optical properties of titanium oxide films as a function of films thickness"

Titanium oxide thin films on glass substrates were prepared by resistance evaporation method under UHV conditions, with different 13, 30 and 58 nm thicknesses in room temperature. The structural and optical properties of the films were systematically examined. The nano-structure of the films were obtained using X-ray diffraction (XRD), and atomic force microscopy (AFM) and their optical properties were measured by spectrophotometer in the spectral range of 300-1100 nm. The optical functions were obtained from the Kramers-Kronig analysis of the reflectivity curves. From X-ray diffractometric measurements (XRD), it has been conformed that the films are amorphous in room temperature. the effect of thickness on nano crystalline Titanium oxides were studied with AFM images. Band-gap energy (Eg) was also estimated for these films. [C32]

"P2-8: Synthesis of MgO quasi one-dimension nanostructure and its field emission property"

MgO quasi one-dimension nanostructures were synthesized via a novel thermal evaporation method, which the temperature of the substrates was higher than that of the evaporation source. The field emission property of MgO nanorods film had been studied and the results displayed that the MgO nanorods film had potential

application in field emission device. [C33]

"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. [C34]

"On the stereochemical nanostructure-based mechanisms of electrical behavior of polymer insulators"

The aim of this paper is to highlight the determining factor of some normal stereochemical nanostructures, especially the mmmr and mmmmrx, termini of isotactic sequence, on the ability of PVC, hydrogenated PVC (as a precursor of PE) and PP to accumulate, release and transport space charges. The correlations found for these polymers by using TSM, TSDC and IDC methods, provide an original interpretation of the space charge behavior of these insulators and open new prospects in the field of property/nanostructures relationships and performances. [C35]

"P2-27: Enhanced field emission from hybrid CuO/ZnO nano-structure"

Field emission is one of the main applications of one-dimensional (1D) nanostructures with enhanced local electric field due to their sharp tips and high aspect ratio. One of such 1D field emitters is CuO nanowires. CuO nanowires are capable of achieving a high field emission current density at relatively low field exhibiting uniform field emission distribution. The enhancement of field emission property of CuO/ZnO nanostructure was reported in this paper. Oriented CuO nanowire films were prepared in ambient atmosphere by using a simple vapor-solid reaction. Hybrid CuO/ZnO nano-structure was fabricated by deposition of ZnO nano thin film using magnetron sputtering. The method presented in this work provides an efficient route to synthesize well-controlled CuO nanowire and hybrid CuO/ZnO nanostructure for nanodevice applications. [C36]

"10.5: Field emission properties of atomically sharp tungsten nanotip arrays fabricated by a novel nanocasting method"

Atomically sharp, high density tungsten nanotip arrays are fabricated by a novel nanocasting technique. Such emitter arrays show excellent field emission properties with a low turn-on field, a high field enhancement factor and good emission stability. They also have better vacuum tolerance than most field emission nanostructures due to a closer cathode-anode spacing allowed by the perfect tip alignment and uniform height distribution. [C37]

"Nanostructured dielectric materials"

This paper presents a progress update with the development of nanostructured dielectric materials for various high energy, high power density electrical applications. It is demonstrated that novel electrical/dielectric properties can be achieved via the nanostructure and interface engineering. We present a high level summary of the progress achieved as well as challenges remaining in nanostructural engineering towards high energy density capacitor for energy storage and conversion, high voltage varistor for surge suppression and high proton conductivity membrane for fuel cell applications. [C38]

"P2-17: The study of W18 O49 nanoneedle emitters"

We show that W18O49nanoneedles may be prepared by thermal vapor deposition without catalyst. Field emission measurement has been carried out and it is found that this new W18O49nanostructure has much better field emission property than W18O49nanowires. [C39]

"P1-23: Effect of ultra-violet light irradiation on electron field emission from titanium-oxide nanostructure"

Field-emission current from titanium-oxide nanostructure is increased by ultra-violet (UV) light irradiation. The enhancement factor of the UV whose wavelength is 365 nm is larger than that of 405 nm. The increased emission current did not decrease even after stopping the irradiation until the sample is exposed to the air. This suggests that the surface cleaning is the origin of the observed current enhancement. [C40]

"Super-resolution fingerprinting in the far field"

We describe a scheme for far-field subwavelength fingerprinting in the mid-IR and THz bands. The approach relies on evanescent wave retrieval, mediated by scattering on a subwavelength nanostructure. [C41]

"Characterization, cathodoluminescence and field-emission properties of morphology-tunable CdS micro/nanostructures"

High-quality, uniform CdS one-dimensional (1D) micro/nanostructures with different morphologies, e.g. microrods, sub-microwires and nanotips, are fabricated through a facile and effective thermal evaporation process. Their structural, cathodoluminescence and field-emission (FE) properties are systematically investigated. Microrods and nanotips exhibit sharp near band edge (NBE) emission and broad deep level (DL) emission, whereas sub-microwires show only the DL emission. A significant decrease in a DL/NBE intensity ratio is observed along a tapered nanotip towards a smaller diameter part. This behavior is understood under consideration of defect concentrations in the nanotips, as analyzed with high-resolution transmission electron microscopy (HRTEM). Field-emission (FE) measurements show that the nanotips possess best FE characteristics with a relatively low turn-on field of 5.28 V/Г‚Вїm and the highest field-enhancement factor of 4819 among all 1D CdS nanostructures reported to date. The field-enhancement factor, turn-on and threshold fields are discussed related to structure morphology and vacuum gap variations under emission. [C42]

"Field emission characteristics of different surface morphologies of ZnO nanostructures formed on carbon nanotubes"

The zinc oxide (ZnO) nanostructure grown onto the carbon nanotube (CNT) surface could enhance the CNT FE characteristics. However, the ZnO nanostructure morphology is an important parameter to decide the FE enhancement. This study used thermal chemical vapor deposition (TCVD) to form ZnO nanostructure onto CNT bundle surface, and adjust the distance (D) between the CNT bundle and the zinc acetate (zinc source) to control the surface morphology of ZnO nanostructures. Transmission electron microscopy (TEM) images showed that the ZnO nanostructures were grown onto the CNT bundle surface uniformly. The FE results show that the optimal D was 32 cm with a tapered shape and the thickness of ZnO nanostructures was about 50 nm, which achieved the lowest threshold electric field. In addition, the ZnO-coated CNT bundles exhibited a good FE uniformity and stable current density. [C43]

"SERS substrate via a low cost and temperature dependence of silver nanostructure"

Based on diffusion-limited aggregation process, a convenient nanotechnique is demonstrated to obtain fractal silver on conductive substrate. SEM and HRTEM images show the morphology nanostructure can be well controlled by the electrochemical process. The as-fabricated silver nanostructure exhibited SERS enhancement factor approximately 105. The study can help us to combine nano-metals and nano-particles for the application in advanced nano devices. [C44]

"Si substrate controlled in-plane synthesis of self-assembled nanostructures catalyzed by Au nanoparticles"

Self-assembled in-plane fabrication of Cu3Si and Mg2SiO4nanostructures were achieved on Si substrates by a simple vapor transport method. The morphologies of the as fabricated structures were controlled by the surface orientation of the substrates, i.e. Cu3Si nanowires (NWs), nanosquares (NSs), and nanotriangles (NTs) were synthesized on Si (110), (100), and (111) substrates, respectively. In the case of Mg2SiO4, NWs with specific growth directions were observed. All the sides of the NTs & NSs and the growth directions of the NWs are along Si <110>, indicating that the symmetries of nanostructure growth break into 2, 4, and 6 folds on Si (110), (100),

and (111). Au nanoparticles (NPs) were used as the catalyst and played critical roles by absorbing metal vapor and breaking the barrier of native oxide layer on Si substrates. The positions of the as fabricated nanostructures were controlled by the Au NPs and the growth of Mg2SiO4NWs can work as a mechanism for transporting Au NPs along specific directions. [C45]

"Fabrication and optical absorption of size-tunable core-shell structured ZnO nanotube-CdTe arrays"

Core-shell structured ZnO nanotube-CdTe nanocomposite arrays have been synthesized by one-step thermal evaporation of CdTe on single-crystalline ZnO nanotube arrays, which are on the ITO glass. The CdTe nanocrystal shells can be formed both at the inner and outer side of the ZnO nanotubes. It is found that the shell thickness is about 100 nm for the ZnO nanotubes with an average 250 nm in diameter and 12 nm in wall thickness. The selective nucleation and growth of the CdTe nanocrystals plays an important role in the formation of the core-shell structure. The inner diameter of ZnO nanotubes has an obvious influence on the product morphology. For smaller inner diameter (such as 150 nm), CdTe nanoclusters will form randomly irrespective of the nanotubes. While thicker CdTe shells with thickness up to ~500 nm can be obtained for larger inner diameter (~600 nm). The absorption of visible light within 826 nm was found to increase linearly with the increasing of the shell thickness for the core-shell nanocomposite arrays. This was attributed to the increased amount ratio of CdTe to ZnO in the composite nanostructure. [C46]

"NO gas sensing properties of ZnO wire-like thin films synthesized by thermal oxidation of sputtered Zn metallic films in air"

We investigated the NO gas sensing properties of the ZnO wire-like films synthesized by thermal oxidation of sputtered Zn metallic films in dry air. Morphological characterization revealed that we synthesized polycrystalline wurtzite ZnO films of a wire-like nanostructure with a width of 100-150 nm and a length of several microns. It was found from the gas sensing measurements that the ZnO wire-like films showed a significantly high sensitivity with a maximum sensitivity of 57.6 for 2 ppm NO at 200Г‚В°C as well as a reversible fast response to NO with a very low detection limit of 50 ppb. These results suggest that the ZnO wire-like films can be used as the gas sensing materials for low-cost and high-performance NO gas sensors. [C47]

"Fabrication of ZnO nanostructures: Effect of organic and inorganic compounds"

Varieties of Zinc Oxide nanostructures have been fabricated by a simple wet chemical method. The growth of the nanostructures was also studied with the use of various organic and inorganic compounds. A morphological change from rod-like structure to nanosheets was observed in presence of those compounds. We also observed a preferential growth of the nanostructure when hexamine was used and the structural form is quite stable as compared to the use of other compounds. [C48]

"Fluorescent super paramagnetic nanoparticles for medical diagnosis and treatment"

There is an increasing need for early detection and treatment of cancer before a tumor mass becomes evident as anatomical anomaly. Highly fluorescent nanoparticles suitable for in vivo detection of tumor cells represent a promising strategy to surpass current limitations in cancer diagnostic and tumor therapy. However, an optimum nanostructure that simultaneously offers multiple functionalities, including intensive fluorescence and therapeutic efficacy, has yet to be developed. In this study, we report the design of a new nanostructure that ideally satisfies important requirements. Quantum dots (QDs) were immobilized on the surfaces of Fe3O4-composite nanospheres (MNS). The QDs on these MNS exhibited intense visible emission by fluorescent spectroscopy and successfully facilitated, for the first time, in vivo soft tissue imaging in live mice. [C49]

"Modeling of temperature sensor built on GaN nanostructures"

Based on the minority-carrier exclusion theory, a model is developed to explain the operating of GaN nanostructure based temperature sensors. The model takes into account different carrier mobility mechanisms. The modeling results show that the resistance of sensor strongly are dependent on GaN doping density and the length of sensor. [C50]

"Fabrication of complex nanostructures by colloidal chemistry"

Structural control of nanomaterials is of paramount significance for nanodevice fabrication. Our group aims to develop methodologies for the synthesis of complex nanostructures by emulating the synthetic methodologies of organic chemistry. Multi-step nano-reactions will be set up so that the products of each reaction step is stabilized, recovered, and then purified for subsequent reactions. We have so far demonstrated several basic

concepts for the colloidal reactions of nanoparticles, such as coupling reaction, valency control, protection schemes, and separation methods. Several novel nanostructures have been synthesized, for examples, core-shell nanoparticles with a variety of surface ligands for multiplexed surface-enhanced Raman scattering detections, high purity dimers and trimers of gold nanoparticles, Janus (two-faced) gold nanoparticles with partial polymer shell, open polymer nanochannels with two diametric openings, triple-layer and yolk-shell nanoparticles, linear chains of gold nanoparticles of variable length, and hetero-aggregates of gold nanoparticles with specific formulae AB, AB2, AB3and AB4. The current focus is to impart specific functionalities to a judiciously designed nanostructure, where the different components could coordinate to achieve a certain function. Generally speaking, solution methods are more facile, scalable, and reproducible than surface-based fabrication methods. The long-term goal is to fabricate nanodevices by multi-step colloidal self-assembly of nano-components. [C51]

"Formation and structural transition of molecular self-assembly on solid surface investigated by STM"

In this presentation, the effect of subtle difference in the molecular structures on the organization of the molecules in the self-assembly was described. Self-assembling and electrochemical techniques were employed to construct two-dimensional organic molecular adlayers on HOPG and various solid structure. Structural details of adlayers have been investigated by using STM and IR spectroscopy. Understanding the weak interactions controlling the organization of molecules on solid surface provides good opportunity to fabricate the sophisticated architectures. Finally, some future directions in the field are outlined. [C52]

"Novel approach to design a testable conservative logic gate for QCA implementation"

In the Low power Nanocomputing era, Reversible and Conservative logic gate design is emerging as an important area of research. In this paper, we present a Novel approach to design conservative logic gate (CLG) using 3Γ́B—3 tile nanostructure, as reversible logic design research gets amplitude. On the other hand study of 3Γ́B—3 tile make fruitful result as it have diverse application, mentioned in this paper. It is a Novel nanostructure that is applied here to implement CLG. The basic principle of CLG is Parity preserving in both input as well as output. Here we applied 3Γ́B—3 orthogonal MV to implement the logic and Cross wire is implemented with the help of 3Γ́B—3 Baseline tile. The main advantage of this design we achieve that the numbers of Layer required only one. It also been demonstrated that the proposed design offers less numbers of QCA cell as well as less area and less clocking zones then the existing counterparts. We also analyzed the logic synthesis using our proposed gate. Here, we also found an effective and promising result and excels all existing counterparts. We demonstrate the testability of proposed CLG by means of behavioral approach of both inputs and outputs. [C53]

"Semiconductor nanowires for energy conversion"

Semiconductor nanowires represent an important class of nanostructure building block for photovoltaics as well as direct solar-to-fuel application because of their high surface area, tunable bandgap and efficient charge transport and collection. In this talk, I will highlight several recent examples in this lab using semiconductor nanowires and their heterostructures for the purpose of solar energy harvesting. In addition, we have also discovered that the thermoconductivity of the silicon nanowires can be significantly reduced due to phonon scattering, pointing to a very promising approach to design better thermoelectrical materials. It is important to note that the engines that generate most of the world's power typically operate at only 30-40 per cent efficiency, releasing roughly 15 terawatts of heat to the environment. If this Γ‚Ïwasted heatΓ‚Ï could be recycled, the impact globally would be enormous. Our silicon nanowire thermoelectric technology could have a significant impact in alternative energy generation. [C54]

"Nanofountain Probes for direct-write nanomanufacturing and in vitro single cell studies"

We present a broadly-applicable nanodeposition tool, the Nanofountain Probe, for direct-write fabrication of functional nanostructures using liquid molecular Γ‚ÏinksΓ‚Ï. Examples of nanopatterning of biomolecules, catalysts for subsequent nanostructure growth, and functional nanoparticle arrays for nanosystems fabrication and single cell studies will be presented. Recent developments in the use of the Nanofountain Probe as an in vitro single cell injection tool are also discussed. [C55]

"Preparation of composition-tunable Cadmium-rich CdS nanotubes and their photocatalytic performance"

CdS nanotubes were generally prepared by surfactant or template assisted ways. The compositions of such nanotubes couldn't be tuned, and especially the yields were usually very low, so that their photocatalysis couldn't

be studied. In this paper, a new photochemical method was introduced to direct synthesize large area cadmium-rich nanotubes by the assistance of air-water interface. Taking CdSO4as the cadmium source and Na2S2O3as sulphur source, a kind of branch-like lamellas with composition difference between the two sides were formed on the precursor surface, under the UV light irradiation. And then the lamellas would bend into Г‚Вїtest tubeГ‚Вї like nanotubes by a Г‚Вїlamellas bendingГ‚Вї mechanism. The compositions of such tubes could be tuned by changing the concentrations of precursor solutions. The tube walls were composed of CdS doped with a little of metal cadmium, and the inners were filled with cadmium partly. This kind of nantubes possessed high photocatalytic activity in photodegradation of methyl orange and it could be changed with the composition of nanotubes. This route is simple, low-cost, environment-friend and universal, and can be extended to synsthesize other sulfide and oxide nanostructures. [C56]

"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. [C57]

"Nearly monodispersed perylene nanotablets: Easy fabrication and unique optical properties"

Here we describe a simple physical vapor deposition (PVD) method to prepare large quantity of highly monodispersed perylene nanotablets with a deposition-temperature controlled approach. The nanotablets we get are 1 um octagon with 100-200 nm thickness. Confocal microscopic images of the nanotablets show novel yellow emission which is quite different from perylene monomers when excited with a UV light of a mercury lamp. The morphology of the unique perylene nanotablets is significantly affected by the temperature of the deposition substrates. This approach is simple and template free and the as prepared nanotablets possess smooth surface which is important for the potential application in fabricating nanostructure based organic semiconductor nanoelectronic devices. [C58]

"Cell-based biosensor system using micropatterned polymer nanofiber"

In this study, to improve efficiency and functionality of cell-based biosensor microarrays, we introduced nano-topographical features on cell adhesive region. Micropatterned surface was created by poly (ethylene glycol) (PEG) hydrogel microstructures via photolithography. Nano-topographical features were introduced using polymeric nanofibers which were produced by electrospinning technique. Combining PEG hydrogel microstructure and polymeric nanofibers created a clear contrast between adhesion resist hydrogel walls and adhesion promoting nanofiber surfaces. When mammalian cells were seeded onto micropatterned nanostructure, cells only selectively adhered to nanofiber maintaining their viability, while adherent cells were not present on the hydrogel wall. [C59]

"Controllable assembly of the Au nanowire in micro/nano structure by templateless electro-deposition"

A novel templateless electrochemical deposition method for controllable assembly of Au nanowire in micro/nano structure was proposed. This method could assemble various nano-patterns (individual, array, network etc.) by utilizing different parameters and characterizes simple-apparatus, low-cost and innoxious-electrolyte. The characterization results prove the fabricated Au nanowires were single-crystal structure with tens of nanometers diameter. The measurement results of the electrical characteristics demonstrate that the Au nanowire has good electric conductivity (the resistivity is 2.64 Г‚ВЃ— 10-7Г‚ВїГ‚В·m). It had the application potentials in micro/nano interconnection, bio/chemical sensors etc.. [C60]

"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 nCS3has 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. [C61]

"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 (Gd2O3). The room temperature quantum confinement effects characterized by the strong intensity and narrow photoluminescence peak in an array of Si quantum dots embedded in Gd2O3, 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. [C62]

"Mechanosynthesis of three-dimensional replicated nanostructures by nanolithography-based molecular manipulation"

This paper reports a nanoscopic mechanosynthesis of three-dimensional (3D) nanostructures by nanolithography-based molecular manipulation (NMM) of target molecules for the applications requiring both physical and chemical anisotropies. The reported molecular manipulators with nanometer-sized patterns and anisotropic surface functionalities are fabricated by exploiting the hybrid nanometer-scale NMM process. They are then utilized for positional nanoassembly of molecules followed by mechanosynthesis producing 3D nanoreplicas. This approach offers "top-down" design and fabrication of morphological features of nanoparticles (NPs). Three types of replicated sub-10 nm polystyrene (PS) nanostructures have been successfully demonstrated in this work, namely, "nanomushrooms", "nanospikes", and high-aspect-ratio "nanofibers". [C63]

"Nanotechnology and nanoscaled materials for microsystems application"

Stages of formation and some perspective aspects of nanotechnology development, in particular, nanoelectronics, getting nanomaterials and microsystems device is analyzed in this report. [C64]

"Effect of substrate position on the formation of ZnO nanostructures synthesized by thermal evaporation of ZnO-CNTs mixture"

In this work, the effect of substrate position on the formation of ZnO nanostructures synthesized by thermal evaporation of zinc oxide (ZnO) and carbon nanotubes (CNTs) on silicon substrate is investigated. The multi-wall CNT powder made by chemical vapor deposition was mixed with ZnO powder with a molar ratio of 1:1. The source material was put into the middle of chamber while Si substrates were placed at various locations from the center to the end of the tube furnace. The evaporation took place at 950°C and 2 Torr under argon gas flow rate of 500 seem and the system was vented at this temperature at the end of process. Structural characterization by scanning electron microscopy showed that ZnO tetrapod-like structures are formed in samples at different positions but they have different densities, sizes and morphologies. The density and size of ZnO nanotetrapods are found to decrease as the distance from source powder increases and substrate temperature decreases. In addition, considerable carbon content and high crystallinity of wurtzite ZnO nanostructure were observed by energy dispersive x-ray spectrometry and x-ray diffraction. Moreover, ZnO nanostructures have a wide blue-green luminescent band between 380 and 600 nm. [C65]

"SPICE macro-model of magnetic tunnel nanostructure for digital applications and memory cells"

This paper presents macro-model and circuit of a spin transfer torque magnetic tunnel junction (MTJ), implemented using two voltage-dependent resistances for parallel and antiparallel layer magnetization. Macro-model suitable for use in any circuit simulators, the problems previously encountered in the convergence of SPICE-like programs eliminated. The efficiency of the model is demonstrated for a MRAM memory, simulation results showed high accuracy and adequacy of the proposed macro-model. [C66]

"Some perspective aspects of nanotechnology development"

Stages of formation and some perspective aspects of nanotechnology development, in particular, nanoelectronics and getting nanomaterials is analyzed in this report. [C67]

"Analyzing the effect of a metamaterial surface on electric and magnetic dipole emissions using Green's function and spatial harmonic analysis techniques"

An approach for calculating the fields radiated from either electric or magnetic dipoles placed inside or at the surface of a multilayer structure arranged of arbitrary elemental materials, including metamaterials, is presented. A combination of Green's function technique and Spatial Harmonic Analysis method is used. The electromagnetic behavior of the dipole sources in the vicinity of the metamaterial surface is studied. This approach is applicable to the important case when the near field of fluorescent molecules is coupled to a multilayer single-periodic or bi-periodic nanostructure. [C68]

"Photonic nano-structure of R. Gigantea"

Rhomborhina Gigantea (R. Gigantea) was examined for its iridescent properties in its exocuticle. The iridescence was explained by the theories of the optical reflectors causing the structural colors and the concepts of cholesteric liquid crystals (CLCs). The exocuticle was examined for its optical properties through experiments of reflection and diffraction. Reflection spectra showed contrast results in transverse electric (TE) and transverse magnetic (TM) modes. The cross-section of the beetle cuticle structure was investigated using scanning electron microscope (SEM). The experimental values of average refraction index (nav) and the half-pitch (Ph) were derived from the optimal Bragg condition. The observed Phfrom SEM images was similar to the experimental values in linear polarization. The average refractive indices determined from the optical data in both TE and TM modes were in god agreement to the predicted value. The consistency of the results implied that the structure responsible for the iridescent beetle was a biological analogue to CLCs. [C69]

"Optimization of periodic nanopore surface texturing for silicon thin film photovoltaic application"

In this paper, nanopore texturing surface is systematically investigated and optimized via simulation for silicon thin film photovoltaic application, where the optical characteristics are closely correlated with the nanopore structural parameters. The result provides an additional design guideline of nanostructure surface texturing for photovoltaic applications. [C70]

"Experiments and Simulation of electron emission form screen printed nanostructure ZnO film"

The Nano-ZnO and nanographite was mixed with other vehicles to form paste. The mixture of nanographite, sintering and anneal treatment process was performed to intentionally improve the electron tunneling and electron emission of screen printed Nano-ZnO film. According to the Fowelr-Nordheim equation, the Matlab simulation programming model was established. Compared the 2D and 3D graphics obtained through the simulation to the curves of the experiments, the direction and shape of the curves is basically similar and confirm the results of experiments. [C71]

"The nanofabrication of CD34 antibody-VEGF-heparin on titanium surface via layer-by-layer assembly for biofunctionalization"

To provide a new strategy for biocompatibility of implanted stents, the surface endothelialization of the metal material is paid more attention. In this work, we focus on the nano-building of a biofunctional layer on the titanium surface with CD34 antibody, heparin, and vascular endothelial growth factor (VEGF) for achieving better compatibility surface. Firstly, Titanium was treated by NaOH solution for obtaining negative charge and forming nanostructure which had been proved to be benefit for the biomacromolecules attachment subsequently. Then, the biofunctional layer was nanofabricated by a layer-by-layer self-assembly (LBL) technique with the above biomacromolecules. The chemical composition, surface roughness topography and contact angle of assembled layer were investigated by Fourier transform infrared spectroscopy (FTIR), atomic force microscope (AFM), scanning electron microscope (SEM), immunofluorescence and water contact angle measurement, respectively. The biocompatibility of biofunctional layer was evaluated by in vitro endothelial progenitor cells culture, in vitro platelet adhesion experiment and the activated partial thromboplastin time (APTT) measurement, etc. The results disclosed that, comparing to the controlled titanium surface, the endothelialization trend and the anti-thrombosis ability of biofunctional titanium surface were obviously improved. The built layer could capture the EPCs from circulated solutions and induced the EPCs differentiation into endothelial cells (ECs). It was supported that the combination of CD34 antibody and VEGF could significantly promote re-endothelialization of Titanium surface. [C72]

"Synthesis of hierarchically organized nanostructured TiO2 by pulsed laser deposition and its application to dye-sensitized solar cells"

Hierarchically organized TiO2nanostructures were synthesized on fluorine-doped SnO2(FTO)/glass substrate at room temperature under various oxygen pressures using pulsed laser deposition (PLD). The microstructures of the obtained TiO2nanostructures were changed sensitively as oxygen pressure. A fully dense structure could be

achieved below oxygen pressure of 50 mTorr. However, ultrafine nanoparticles (5~15 nm) were produced over 50 mTorr and they assembled hierarchically in ordered forest consisted of characteristic tree-shaped structures. The hierarchical assemblies were gradually to be porous and finally the tree shape was disappeared and the assemblies were disordered with increasing oxygen pressure. The synthesized TiO2nanostructures were changed from amorphous to anatase phase without morphological changes after air annealing at 450Г‚В°C for 1 hour. The anatase nanostructures were applied to dye-sensitized solar cells (DSSCs). Cell performance and electron diffusion characteristics of the hierarchical anatase assemble prepared by PLD as photoelectrode were investigated in DSSCs. Optimal TiO2nanostructure synthesized by PLD for photoelectrode in DSSCs was discussed in terms of electron transport and dye absorption. [C73]

"Effect of nano structure anhydrous agnesium carbonateon fire-retardant performance of PLA/BF composites"

PLA/BF composites,which are extremely flammable, must be carried out fire-retardant processing. However, traditional organic flame retardants release certain amount of pollutant to the environment, and inorganic flame retardants require more addition,which influenced the mechanical properties of composites. Therefore, nano inorganic flame retardants, which have some characteristics of small size, uniform shape and high specific surface area, can bring good flame-retardant effect with relatively few addition. Meanwhile, it can enhance the interaction of composites interface, and disperse more evenly in polylactic acid (PLA)matrix. Furthermore, it has light influence on the physical mechanical properties. In this study, nano structure anhydrous magnesium carbonate is used as flame retardant, Cone Calorimeter and Dynamic Thermal Mechanical Analyzer are adopted for studying the fire-retardant properties and the dynamic thermodynamic parameters of the PLA/BF composites, respectively. Results show that nano structure anhydrous magnesium carbonate flame retardant have good fire-retardant performance for the PLA/BF composites, considering practicality and economy, its ideal addition is 5%. [C74]

"Effect of surface topography of zirconia coating on its bioactivity and osteoblast response"

12.8mol% calcia-zirconia coatings with nanostructured surface were prepared using plasma spraying technology. The bioactivity, cytocompatibility as well as their correlation with the surface topography and nanostructure of coatings were explored. Simulated body fluid (SBF) immersion test shows that the as-sprayed zirconia coating can induce apatite precipitation on its surface, whereas the heated and polished ones can not. It indicates the significant role of the nanostructured surface on the bioactivity of zirconia coating. In vitro MG63 cells culture experiments revealed that rough surface are beneficial for cell spreading and cellular skeleton reorganization. In addition, it was proved that nanostructure can enhance cell proliferation. [C75]

"Preparation and photocurrent response of ZnO/TiO2 nanotubes composite"

We prepared ZnO/TiO2nanotubes (TNTs) composite via a two-step route. First, the highly ordered TNTs was prepared by anodization. Then different morphology of ZnO nanostructures were deposited on the surfaces of TNTs by cathodic electrodeposition method. With increasing of the deposition voltage, the morphology of the deposited ZnO nanostructure was gradually changed from nanoparticles to nanocotton and nanodonga. Increasing the deposition time, from nanoflower to puff nanorod of the deposited ZnO nanostructure was successfully achieved. The morphology and crystallinity of nanocomposites were studied by SEM and XRD. Photocurrent response was measured in 0.01M Na2SO4under the UV-Vis illumination. [C76]

"Highly ordered growth of ZnO nanostructures by combination of nanoimprint lithography and hydrothermal method"

By combining nanoimprint lithography and traditional hydrothermal growth method of ZnO nanorods, vertical and well patterned ZnO nanostructures were successfully fabricated. The imprinted SU-8 resist deep trenches above the ZnO seed layer prohibit the lateral growth of ZnO nanorods. Various patterned vertical ZnO nanostructures like nanorods and nanowalls can be obtained. The improvement of photoluminescence property of ZnO nanorods was observed after removing the SU-8 resist from the substrate by O2reactive ion etching (RIE). [C77]

"Photoreflectance spectroscopy with a Fourier-transform infrared spectrometer: From visible to far infrared"

Recent progress in photoreflectance spectroscopy at the Shanghai Institute of Technical Physics was reviewed, with the focus on the extension of functional spectral range for the first time from 5 μm to FIR of 20 μm and the application to narrow-gap semiconductors and nanostructure materials. [C78]

"A study of temperature effect on vertically aligned carbon nanofibers for bio/chemical sensors development"

One of the major limitations in the development of ultrasensitive electrochemical biosensors based on one dimensional nanostructure is the difficulty involved with reliably fabricating nanoelectrode arrays (NEAs). In this work, to ensure nanoelectrode behavior and higher sensitivity, Vertically Aligned Carbon Nano Fibers (VACNF) are precisely grown on 100 nm Ni dots with 1μm spacing on each micro pad. However, in order to examine the quality and measure the height and diameter of the VACNFs, a surface detection and measurement tool at the nanoscale level is employed. In this paper, we introduce an approach to measure these nano-scale features through Atomic Force Microscope (AFM). With this method, both the 2D and 3D images of sample surface are generated and the sizes of carbon nanofibers are obtained with statistical analysis. Furthermore, temperature effect on the dimensions of VACNFs is studied. [C79]

"Creation and detection of spin-polarized current in the scanning-tunneling-microscope"

Spin polarization of carriers was studied when the carriers were being transported from a non-magnetic scanning-tunneling-microscope tip to a GaAs substrate through a ferromagnetic nanostructure at room temperature. The spin polarization was estimated by measuring the circular polarization of light created by a radiative recombination of the carriers in the GaAs sample. The circular polarization measured shows that non-spin-polarized carriers in the non-magnetic PtIr tip changed to spin-polarized ones in the GaAs substrate when they were transported through thin Fe layers. The high spin polarization of the carriers was caused by the unoccupied state of minority-band of the Fe layer and suggests a promising method to achieve spintronic devices at room temperature. [C80]

"In-situ nanowire array synthesis in the microchannel for microfluidic devices"

We have developed a novel method to synthesize and integrate one dimensional nanostructures within microfluidic chip via hydrothermal reaction with the microchannel as a physical constraint. Precursor solution of metal oxide (ZnO) nanowire is flown through the microfluidic channel while the thermal energy is supplied either throughout the entire chip by heating plate or near selected regions by microscale metal heaters. This global or localized heating of ZnO precursor solution allows hydrothermal growth of ZnO nanowires and their in-situ integration within microfluidic channel. This novel method is expected to be used as a convenient route to the fabrication of nanostructure-based chemical / biological filters and electrodes for electrochemical sensors for microfluidic lab-on-a-chip systems. [C81]

"2-inch full wafer nanoimprinting for GaN-based LEDs"

A rapid and cost effective method for nanostructure fabrication in a large area was proposed in this paper. The integration of conventional ultra-violate lithography and self-developed technique was adopted to fabricate 700 nm nanocasts. Polydimethysiloxane (PDMS) was used to be a flexible mold material for the 2-inch wafer area uniform imprinted structures. This rapid structure fabrication technique can be applied to commercialized light emitting diode as a texturing surface to raise the light extraction efficiency significantly. [C82]

"Hydrothermal synthesis of In2 O3 nanocubes and their gas sensor properties"

Single crystal In(OH)3nanorods and nanocubes were hydrothermally synthesized from aqueous InCl3solution. Indium hydroxide, In(OH)3, was precipitated at 90°C for 12 h and was changed into a transient In2O3phase upon calcination at 400°C for 1h in air. The increase of the concentrations of indium chloride tetrahydrate would promote the formation of cube-like nanostructures. In order to understand the growth mechanism of the nanocubes, by different growth time, we can find nanocubes are primarily guided by oriented attachment. At the operating temperature of 300°C, the sensitivity is up to 2.25 and 3.25 as the sensor is exposed to 10 and 200 ppm carbon monoxide gas, respectively. [C83]

"Nanostructure covered micro holes fabrication by femtosecond laser on fused silica glass surface"

We report on the fabrication of nanostructure covered micro holes on the surface of fused silica glass by irradiation with single-beam direct femtosecond laser pulses. Nano-bumps or nano-pillars were formed on the side wall near the surface as well as near the bottom of the micro holes with a diameter down to 100nm. On the top of the nano-bumps, grouped and spherical shaped nanostructures down to 10 nm were observed. Nano-gratings with an average period of 175 nm-200 nm were found at the bottom of the holes, which is less than λi/2η period (η is the refractive index of the material). [C84]

"Germanium catalyzed amorphous silicon dioxide nanowire synthesized via thermal evaporation method"

Summary for only given. One-dimensional (1D) nanostructures have been attracting great interest because they have opportunities for potential applications in nano-electronics and optoelectronics. SiO2has attracted great attention due its potential application such as laser emitter, panel displays and sensors [1], Various SiO2nanowires have been produced by several methods, mostly vapor-liquid-solid (VLS) mechanism using different metal catalyst including thermal evaporation [2-4], chemical vapor deposition [5] and laser ablation [6]. Recently, Liu et al. [7] have studied the magnesium catalyzed growth of SiO2hierarchical nanostructures by a thermal evaporation process. In this paper we report a simple thermal evaporation technique (horizontal tube furnace) to grow the bulk-quantity of the Ge-catalyzed amorphous SiO2nanowires on the Si substrate by using germanium (Ge) powder as catalyst. The nanostructure and optical properties of the Ge-catalyzed amorphous SiO2nanowires have been investigated by scanning electron microscopy (SEM), transmission electron microscopy (TEM), energy-dispersive X-ray spectroscopy (EDX), X-Ray diffraction (XRD) and photoluminescence (PL) spectroscopy. The investigation of structural properties indicated that the structures consist of SiO2nanowire with diameters around 70-400 nm and length of about 2-40 μm (Figure 1). EDX reveals that the nanowires structures have Ge, Si and O2compositions and XRD analysis confirmed the product is typical amorphous structure. Room temperature photoluminescence (PL) spectrum (Figure 2) shows emission peak was at about 390 nm, opening up a route to potential applications in future optoelectronic devices. [C85]

"Nuclear magnetic resonance in GaAs-AlGaAs nanostructure devices"

We present preliminary measurements of resistively detected nuclear magnetic resonance (NMR) in GaAs-AlGaAs quantum point contacts (QPC). Nuclear spins in the host crystal are polarized through the hyperfine interaction with carriers near the QPC; this polarization can be detected via the four-terminal resistance and manipulated with a radio-frequency magnetic field. [C86]

"Fabrication and characterization of integrated field emission diodes using self-assembled-silicon-nanostructure cathodes"

CMOS process compatible integrated diodes using self-assembled-silicon-nanostructure cathodes have been fabricated and characterized at atmospheric pressure. The silicon nanostructures are atomically sharp and about 10 nm high, self-assembled on a silicon substrate by electron beam annealing (EBA). The electrical conduction characteristics of the devices show Fowler-Nordheim field emission at high fields. A field enhancement factor, β, of about 5Ч105cm-1and silicon effective work function, Φeff, of about 0.21 eV are reported for the devices. [C87]

"Physical reason behind far-field transmission resonances from U-shaped metallic structures"

The far-field transmission spectrum of crescent-like metallic nanostructures on a glass substrate at normal incidence is studied numerically. The interpretation of transmission resonances arising from a periodic subwavelength U-shaped metal nanostructure in terms of plasmonic eigen modes is revisited. [C88]

"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. [C89]

"GeSi/Si nanostructure formation by Ge ion implantation in (100) silicon wafer"

In this work, two kinds of thermal annealing methods were used to process the silicon wafer by Ge ion bombardment in two steps, dose of 7Ч1016/cm2with 150KeV and dose of 2.72Ч1016/cm2with 50KeV respectively. In order to control the defects density and Ge distribution in SiGe layer, furnace annealing (FA) and rapid thermal annealing (RTA) schedules were used. It has been found that the FA after ion implantation could

produce a high density of SiGe nanoclusters more than RTA. The results show that the SiGe nanostructure is matched with the Si matrix. [C90]

"Strong Fault-Tolerance for Self-Assembly with Fuzzy Temperature"

We consider the problem of fault-tolerance in nanoscale algorithmic self-assembly. We employ a standard variant of Winfree's abstract Tile Assembly Model (aTAM), the two-handed aTAM, in which square "tiles"-a model of molecules constructed from DNA for the purpose of engineering self-assembled nanostructures-aggregate according to specific binding sites of varying strengths, and in which large aggregations of tiles may attach to each other, in contrast to the seeded aTAM, in which tiles aggregate one at a time to a single specially designated "seed" assembly. We focus on a major cause of errors in tile-based self-assembly: that of unintended growth due to "weak" strength-1 bonds, which if allowed to persist, may be stabilized by subsequent attachment of neighboring tiles in the sense that at least energy 2 is now required to break apart the resulting assembly, i.e., the errant assembly is stable at temperature 2. We study a common self-assembly benchmark problem, that of assembling an nЧn square using O(log n) unique tile types, under the two-handed model of self-assembly. Our main result achieves a much stronger notion of fault-tolerance than those achieved previously. Arbitrary strength-1 growth is allowed, however, any assembly that grows sufficiently to become stable at temperature 2 is guaranteed to assemble into the correct final assembly of an nЧn square. In other words, errors due to insufficient attachment, which is the cause of errors studied in earlier papers on fault-tolerance, are prevented absolutely in our main construction, rather than only with high probability and for sufficiently small structures, as in previous fault tolerance studies. [C91]

"Recombination dynamics of excitons in phosphorus-doped ZnO nanostructures"

The optical properties of an undoped and a P-doped ZnO nanostructures have been studied by means of photoluminescence (PL), time-resolved PL, and spatially-resolved cathodoluminescence (CL) spectroscopy. The luminescence bands due to the radiative recombination of biexcitons and the exciton-exciton scattering process were observed. The binding energy of excitons and biexcitons was estimated to be 60 and 15 meV, respectively. Radiative and nonradiative recombination lifetimes of free excitons were estimated from temperature dependence of the PL lifetime and the time-integrated PL intensity. Although the radiative recombination lifetime for each sample was almost equal, the nonradiative recombination lifetime for the P-doped sample was longer than that for the undoped sample. This result suggested that the thermal activation of nonradiative recombination process was suppressed by the P doping. CL images revealed that the intensity of the side surface was much stronger than that of the interior in the P-doped sample. This result indicated that the P impurities were distributed around the surface of the nanostructures. [C92]

"Label-free biosensing using a nanostructured Fabry-Perot interferometer"

This paper reports a novel label-free biosensor based on a nanostructured Fabry-Perot interferometer (FPI) for the first time. Au-coated nanostructure layer inside the FPI offers significantly enhanced optical interference signals due to localized surface Plasmon resonance (SPR) effect. Immobilization of capture protein, Protein A, on the nanostructure layer and its binding with immunoglobulin G (IgG) inside the FPI are monitored in real time, resulting in interference fringes shift of the signals. Fourier transform (FT) is performed on the measured reflectance interference spectrum. Only a single peak whose X-axis position is the effective optical thickness (EOT) of nanostructured layer is presented for each spectrum, which simplifies the quantified analysis of the signals. Current results show that the detection-of-limit (DOL) of the biosensor should be much lower than 5ng/ml. [C93]

"Semiconductor nanostructures in crystalline rare earth oxide for nanoelectronic device applications"

In this paper, we will demonstrate a novel approach to incorporate Si and/or Ge nanostructures into crystalline rare earth oxides using molecular beam epitaxy (MBE) for nanoelectronic devices application. By efficiently exploiting the growth kinetics during MBE we succeeded in creating semiconductor nanostructures exhibiting various dimensions, ranging from three dimensionally confined quantum dots (QDs) to the quantum wells, where the particles are confined in one dimension. The crystalline rare earth oxide that has been used in this study is the epitaxial gadolinium oxide (Gd2O3). The monolithic heterostructures comprised of Gd2O3-Ge/Si-Gd2O3grown on Si substrate exhibit excellent crystalline quality with atomically sharp interface. [C94]

"Quantum-wire conductance manipulating by asymmetric quantum dot-molecules"

The electronic conductance at zero temperature through a quantum wire with side-attached asymmetric quantum dot-molecules (as a scatter system) is theoretically studied using the non-interacting Anderson tunneling

Hamiltonian method. We show that the asymmetric configuration of QD-scatter system strongly impresses the amplitude and spectrum of quantum wire nanostructure transmission characteristics. It is shown that whenever the balanced number of chains-quantum dots in one molecule is substituted by unbalanced scheme, the number of forbidden mini-bands in quantum wire conductance increases to the sum of the number of quantum dots in two chains and thus the QW-nanostructure electronic conductance contains rich spectral properties due to appearance of the new anti-resonance and resonance points in spectrum. Considering the suitable inner gap between QD-chains in one molecule or outer gap between QD-molecules, can strengthen the amplitude of new resonant peaks in QW conductance spectrum. The proposed asymmetric-QD scatter system idea in this paper opens a new insight on designing quantum wire nanostructures for given electronic conductance. [C95]

"Beam alignment in Laser Interference Nanolithography"

Laser Interference Nanolithography (LInL) can produce nanostructure patterns by two or more coherent laser beams on the sample surface. In LInL, incident positions, incident angles and space angles of beams determine the lithography pattern and exposure area. In this work, a method for beam alignment in LInL was described. The method is based on the detection of the light spot which is formed by the incident beam on the sample surface, obtaining the parameters of the light spot by image processing including the incident position, incident angle and space angle of the beam. Proper system alignment can eliminate errors of beam incidence to ensure that the final lithography pattern and the exposure area can comply with the design. Computer simulation and experimental results have shown the accuracy, repeatability and limitation of the method, and it can be used in laser interference nanolithography. [C96]

"Cost-efficient fabrication of UV/Vis nanowire (NW) photodiodes enabled by ZnO/Si radial heterojunction"

Radial heterojunction nanowires (NWs) using a ZnO(shell)/Si(core) coaxial structure are for the first time reported for a novel photodiode application. Strong antireflective characteristics are shown by employing vertically aligned Si NW arrays. A thin ZnO shell deposited onto a Si NW formed a radial junction which enabled effective separation of charge carriers. Furthermore, a ZnO nanostructure demonstrates a very high internal gain in photoconductivity due to the surface-enhanced electron-hole separation. The photodetection range, either ultraviolet (UV) or visible, can be determined by applying forward or reverse bias, respectively. Compared to a planar heterojunction photodiode, a photoresponsivity of the radial heterojunction structure shows similar values despite only ~20% consumption of a ZnO thickness required for a planar junction. In addition, ~2.5 times increase in UV responsivity is also presented using the radial heterojunction structure under the ZnO thickness same as a planar counterpart. Our coaxial ZnO/Si NW photodetectors suggest bright prospect for enhancing a photoresponsivity while less consuming ZnO via controlling the wired nanostructure. [C97]

"Resonant coupling of surface and bulk plasmon polaritons in metallic nanostructures"

Sub-nanometer transition layers that arise at interfaces between a metal and a dielectric sufficiently modify wave-guiding properties of metallic nanostructures. Through nonuniformities occurring inside the transition layers, the plasmon polariton modes maintained by a metal/dielectric interface couple to each other and change energy confinement in the nanostructure. In order to investigate this coupling, a continuous transition arising at a flat interface between gold and silicon dioxide is studied and analyzed with respect to the eigen modes supported by such a waveguide structure. [C98]

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

Three-dimensional nanostructure fabrication has been demonstrated by 30 keV Ga+focused-ion-beam chemical-vapor-deposition (FIB-CVD) using a phenanthrene (C,4Hı0) 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 threedimensional 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. [C99]

"Nanostructured carbon electrodes for energy storage"

Current work on using nanostructured carbon surfaces in supercapacitors and batteries to enable enhanced performance is discussed. The emphasis is on solid electrolyte based batteries and supercapacitors which can

be flexible and change form factor. This is a new concept for energy storage systems driven by the requirements of next generation mobile communication devices which will be designed to supplement regular battery power with power from harvested energy. It will be shown that a new class of flexible suprecapacitors and batteries can be realised through use of carbon electrodes with enhanced nanostructure. In particular Carbon nanohons (CNH) are considered. CNHs are formed in 'crushed' or 'origami -like' graphene sheets. They form into 10 -50 nm diameter particles with a high degree of open pores having high surface area and permeability. The variable spacing between 5nm -lnm of two graphene sheets in CNH introduces a new surface energy regime for intercollation of ions. Results from applying CNH in electrodes in supercapacitors and batteries are presented. The power density of a flexible supercapacitor, for example, can be increased very significantly by designing nanostructure into the carbon electrodes. The devices under consideration are aimed at powering mobile electronic and autonomous sensing systems. However, the potential of scaling of the technology to larger energy storage systems is viable. [C100]

"Tuning of surface plasmons in visible and near infrared range using plasmonic crystals"

Surface plasmons (SPs) are electromagnetic waves propagating along metallic-dielectric interfaces which can be supported by structures at broad scales and can find extensive applications from sensing to optical waveguiding. SPs can take different forms, from free waves to localized oscillations depending on different geometries. The excitation of the spectrum of a plasmonic nanostructure is determined by its collective electronic oscillations. Furthermore, the plasmon modes of a nanostructure are determined by its composition, scale and shape. Plasmonic coaxial nanostructures have drawn considerable attention recently because of their fascinating properties and their great potential as an important canditate of ultracompact optical devices. Here, we demonstrate tunable optical response using coaxial apertures with ultrasmall gaps (less than 50 nm) and nanorods with square lattice fabricated using focused ion beam milling and e-beam lithography followed by argon ion milling, respectively. [C101]

"Sensitivity analysis for nanostructure metrology by Mueller matrix polarimetry"

This paper presents the modeling and simulation of Mueller matrix polarimetry for nanostructure metrology, with an emphasis on the sensitivity analysis. Taking a two-dimensional grating as an example, the modeling method using the rigorous coupled-wave analysis theory has been described. The Mueller matrix elements are obtained with different measurement configurations, such as changing the wavelength and azimuthal angle. It is observed that different geometrical parameters show variable sensitivities even under a fixed measurement configuration, and more information is achievable by changing the configuration. It is thus verified that it is feasible and effective to characterize nanostructures by the Mueller matrix polarimetry. [C102]

"A study of temperature effect on unetched and etched Vertically Aligned Carbon Nanofibers for bio/chemical sensors development"

One of the major limitations in the development of ultrasensitive electrochemical biosensors based on one dimensional nanostructure is the difficulty involved with reliably fabricating, testing and characterizing nanoelectrode arrays (NEAs). In this work, to ensure nanoelectrode behavior and higher sensitivity, Vertically Aligned Carbon Nano Fibers (VACNFs) are precisely grown on 100 nm Ni dots with 1µm spacing on each micro pad. However, in order to grow nanofibers uniformly, a detailed study on etchant effect and temperature is required. In this paper, we study temperature effect on unetched and etched VACNFs and measure these nanoscale features with Atomic Force Microscope (AFM). With this method, both the 2-D and 3-D images of sample surface are generated and the effect of temperature on carbon nanofiber dimensions (diameter and height) is statistically analyzed. [C103]

"Metal enhanced fluorescence on silver nano-triangles"

Fluorescence has many desirable applications in analytical tools in the field of biochemistry and molecular biology. In most of the applications the fluorescence is observed in far field and the detection of fluorescence from biological samples demand low concentration and sensitive techniques that can enhance fluorescence signal. In order to realize this, metal enhanced fluorescence is employed where an increase in fluorescence is observed when the fluorophore is in close proximity to a metallic surface. The preparation of suitable and reproducible metal nano-structure surfaces at low cost has been difficult, hence limiting its utilities. To overcome these limitations, we report the fabrication of silver nano-triangles using nano-sphere lithography which uses a 2D mono-layered nano-sphere array as the mask and using the same for enhancing fluorescence from Fluorescein isothiocyanate. The proposed method is inexpensive, simple to implement and a high throughput nano fabrication technique. [C104]

"Nanostructured materials for sensing and imaging"

From semiconductor quantum well structures to the currently hottest metamaterials, the conquest of nano-world has been occurring in almost every field of research. In the field of quantum well structures for infrared photodetection, the inclusion of dilute nitride layers in the mature GaAs based quantum well structures results in a TE dominate photocurrent and the incorporation of nitrogen in the narrow bandgap InSb materials makes it possible for wide band infrared absorption covering mid and long wavelength infrared range. With the nanostructured materials made of metal and dielectric composites, visible light can be manipulated, which has potential application for super resolution imaging beyond diffraction limit. [C105]

"ZnO nanoporous structure growth, optical and structural characterization by aqueous solution route"

In this paper, the growth, optical and structural characterization of ZnO nanoporous structures on plastic substrate using low temperature aqueous chemical growth technique. ZnO nanoporous structures were fabricated using hydrolysis process by reacting zinc acetate dehydrate with pure ethanol. The ZnO particle size and morphology was observed by X-ray diffraction (XRD), atomic force measurement (AFM), field emission scanning electron microscope (FESEM) and transmission electron microscope (TEM). The dimension of the as grown nanoporous structure depend on the molar concentration of zinc acetate and HMT. The control dimensions ranges from 50-300 nm and exhibited ordered nanostructure preferably along (002) plane.Photoluminance measurements of ZnO was observed using UV- Spectrophotometer. [C106]

"Nanostructure evolution of titanium dioxide layers from titanium thin films using hydrothermal treatment"

In this study, a hydrothermal route is advanced for the formation of titanium dioxide nanostructures. The wetting properties and structure evolution of the hydrothermally grown TiO2nanostructures are studied. Sputtered titanium thin films have been treated under hydrothermal conditions. The results show that the morphologies, microstructures and surface properties of the TiO2nanostructured films vary with increasing hydrothermal treatment times. Prolonged hydrothermal treatment leads to the formation of TiO2nanorods. [C107]

"Tungsten oxide nanoporous structure synthesized via direct electrochemical anodization"

In this paper, the synthesis of tungsten oxide nanoporous structure were studied. The nanostructure were synthesized via direct electrochemical anodization for 15 min. The samples were annealed at 500 C for 1 hour. Raman analysis were also conducted in the anodized and annealed samples. [C108]

"Silver nanoclusters formation by using thermal annealing on porous GaAs"

In this paper, theoretical interaction between semiconductor and metal nanoparticles assembled into superstructures is studied. Silver (Ag) was used to fabricate nanosized metal particles embedded in porous GaAs (π-GaAs). The formation of the porous GaAs layers was illustrated in simple measurement. First, the π-GaAs was obtained using conventional electrochemical etching method which will change it into nanostructure where the structure becomes more stable and increases it effectiveness. Then, Ag layer was sputtered onto π-GaAs with thickness about 10nm using RF sputtering and then undergo thermal annealing process with different temperatures at 600, 700 and 800°C. The silver nanoclusters formation with different sizes has been confirmed by scanning electron microscopy(SEM)and then was subjected to photoluminescence (PL)and Raman measurement.The SP propagation along metal/surface is determined by various factors such as the size and shape of metal islands.Having a highly anisotropic shape the silver nanoclusters are expected to show complex behavior of SP oscillations. [C109]

"Formation and characterization of silicon self-assembled nanodots"

One of the most important fields in semiconductor physics is study the nanostructure of materials with dimensions less than 2-like quantum dots -QD. Si quantum dot is one of typical material used in nanostructure, because of their unique and useful functions caused from quantized electron energy state. Although various formation techniques have been developed so far to achieve high-density and nanometer-size. In general silicon QDs can be formed on non-crystalline substrates, such as glass. Si quantum dots have been successfully grown on corning glass (7059) substrate. This nucleation starts to appear at first 7 min of QDs growth formation until stable conditions of the dots. The measurement results estimated average dots size to be 53 nm is confirmed by using AFM. The most common technique RF magnetron sputtering system that deposit Si-QDs depend on plasma excitation at high temperature of more than 500°C. The effects of variety parameters of temperature, gas

flow rate, and RFpower obtain different Si-QDs structural properties, as in fig (1). Also, by analyzing their structural and optical properties, may get the best growth formulation of Si-QDs, table (1). Nanotechnology is dealing with nanostructure of materials and its properties change radically as their size decrease, that have follow down almost the atomic energy levels. The PL peak located at 687 nm, fig (2), that informed band gap energy = 1.807eV. The formation of Silicon on the substrate confirms using EDX measurement, fig (3). The physical characteristics of the substrate (lattice parameter, crystalline structures and surface free energies) are leading to diverse the growth modes, fig (4) [2]. This result support Usual Si atomic structure defect could be a dominating obstacle to high luminescence efficiencies. Si-QDs have been studied due to proposed future applications in electronics and photonic devices. On the other hand it's a common technique that promises to fabricate single-electron memo--ry (SEM) and transistor (SET) devices on a single integrated chip that hasn't enough consideration. [C110]

"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. [C111]

"Creation of nanostructures via self-assembly at room temperature, cluster structures and dynamics, and bio-nano fusion technology"

Creation of nanostructures utilisins 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. [C112]

"Syntheses and characterization of a new nano-structure lead (II) coordination polymer by sonochemical method"

Summary form only given. Nano-structure of a new Pb(II) two-dimensional coordination polymer, [Pb(2pyc)(N3)(H2O)]n(1), 2-Hpyc =2-pyridinecarboxylic acid} were synthesized by a sonochemical method. The new nano-structures were characterized by scanning electron microscopy, X-ray powder diffraction, IR spectroscopy and elemental analyses. Compound 1 was structurally characterized by single-crystal X-ray diffraction and consists of two-dimensional polymeric units. The thermal stability of compounds 1 was studied by thermal gravimetric and differential thermal analyses and compared. PbO nanopowders were obtained by calcinations of the nano-structure of compound 1 at 400°C. This study demonstrates the coordination polymers may be suitable precursors for the preparation of nanoscale materials and dependent on their packing they may produce different and interesting morphologies. [C113]

"Nanostructures and devices"

Nanostructures have been attracted great attentation for many years due to their novel properties and advantages associated with the scale. In this plenary talk, I will present the artificial nanostructures and devices developed in our group. I will also discuss their applications in light source, light manipulation and high resolution

imaging for next generation photonic technology. [C114]

"Sphere-on-pillar optical nano-antennas"

We propose an optical nano-antenna consisting of a pair of sphere-on-pillar structures. Experiments show that the controlled fabrication of metallic nanospheres on the tip of carbon nanotubes (CNTs) is effective, and numerical investigation revealed that a pair of such structures are capable to convert free space radiation into an intense near-field; hence can function as an optical antenna. The fabrication process, electron-beam-induced bubbling (EBIB) and electromigration-based bubbling (EMBB), are based on nanofluidic mass delivery at the attogram scale using metal-filled CNTs. 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. In the case that the encapsulated materials inside the CNT have a higher melting point than that of the beam energy can reach, electromigration-based mass delivery is an optional process to apply. Under a low bias (2-2.5V), spherical nanoparticles are formed on the tips of nanotubes. The optical properties of the nano-antenna are analyzed numerically using the finite element method. Our investigations have revealed that the field enhancement, the resonances, and the radiation patterns can be easily tuned since all these quantities strongly depend on the size of the nanotubes and the metallic spheres, as well as on their material properties. Sphere-on-pillar optical antennas carry a great potential for bio-sensing, tip-enhanced spectroscopy applications, and interfacing integrated nanophotonic circuits. [C115]

"SHF stand for performing high-temperature chemical processes"

SHF stand for performing high-temperature chemical processes is designed. SHF stand includes high-Q cavity excited on H102mode and the magnetron SHF generator of the level of SHF power of 1 kW, the operating frequency of 2470±100 MHz. The power of energy release up to 100 W/cm3, the rate of heating is more than 1000°C/sec. The study of selective catalytic pyrolysis of high-molecular hydrocarbons is performed. The formation of carbon nanostructure from alkanes has studied. [C116]

"Sub-millimeter diodes on base of single-barrier nanostructure"

A small-signal model of GaN/AlGaN/GaN nanostructural diode with electron tunnel injection through AlGaN potential barrier and transit in GaN drift layer is created considering tunnel injection delay. Parameters and impedance characteristics are determined for the sub-millimeter diodes. [C117]

"Experimental Research on Producing Nanostructured Materials by Machining Al6061-T6 with Large Strain"

The method of machining Al6061-T6 with large strain to produce nano-materials was introduced, and the influence of cutting parameters on the microstructure was studied. The shear strain of chip which is important to the microstructure was analyzed theoretically and simulated by finite element. Bright-field TEM images and SAD patterns were obtained and used to study the microstructure of the chip. The result shows that, the shear strain of the chip worked by simplified formula is similar to the result of finite element simulation. The size of the grain of chip is reduced when the shear strain increased and the fine grain less than 100nm can be obtained when the shear strain is large enough. [C118]

"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. [C119]

"Molecular single-electron transistor on basis of planar nanostructure"

The investigation of the effects of correlated tunneling in the molecular nanostructures at room temperatures has been carried out. The model of molecular single-electron transistor on the basis of planar techniques has been developed. [C120]

"Novel semiconductor optical amplifier with tapered active channel"

Tapered semiconductor optical amplifier (SOA) based on SQW improved nanostructure (gain maximum at 840 nm) was used as output power amplifier in MOPA-system with SLD as master oscillator. CW output power of up to 0.5 W ex standard multimode fiber (MMF) was obtained. [C121]

"Effect of phonon confinement on heat dissipation in ridges"

We have investigated experimentally the effect of lateral confinement of acoustic phonons in ridges as a function of the temperature. Electrical methods are used to generate phonons in 100nm large nanostructures and to probe the nanostructure temperature in the same time, what allows tracking the heat flux generated and its possible deviation from Fourier diffusive heat conduction. We compare our results with those of a recent theoretical paper based on the ballistic-diffusive equations. [C122]

"Absorption of visible and infrared radiation in nanostrucures with energy profile of irregular shape"

The processes of absorption of radiation of visible and infrared bands in the nanostructure, energy profile of which consists of the rectangular quantum well and the rectangular cavity in its central part, are considered. The possibility of intensification of absorption lines at the expense of variation of technological parameters at the stage of the constructional design and manufacturing is considered. [C123]

"Characteristics of hybrid multiwall nanotubes"

The model of transistor nanostructure on the basis of hybrid five-wall nanotube (NT) consisting of three carbon one-wall NT with metallic properties between which two boron-azotic NTs are allocated, has been developed. Considering the carbon nanotubes (CNTs) as contact electrodes of the cathode, the anode and the control electrode, it is obviously possible to drive tunnel current of structure by means of potentials on the anode and the control electrode both at room temperature and at low (~20 K) temperatures. [C124]

"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. [C125]

"Absorption coefficients of quantum dot intermediate band material with negligible valence band offsets"

Solar cells with quantum dot nanostructure absorbing medium have a potential to overcome single junction limit and achieve the solar energy conversion efficiency as high as 63%. The confined energy states in quantum dots can mediate the absorption of photons with energy lower than the band gap of the barrier material. Closely spaced array of quantum dots (QDs) can form a mini band due to electronic coupling of the confined states among the neighboring dots. Absorption properties of the quantum dot nanostructures are different from that of a bulk material. For the detailed balance efficiency calculations, the absorption coefficients of the QD nanostructures are required for realistic QD structures. After finding out material combinations with negligible valence band offset for quantum dot intermediate band solar cells(QDIBSCs), present work is focused on the calculation of absorption coefficients of QD arrays. The confined electronic states are calculated with the effective mass theory for single and coupled quantum dots. The electronic coupling of the ground states of an array of quantum dots is calculated for negligible valence band offset material combinations (especially InAs dots in GaAs(0.84)Sb(0.16)matrix grown on [001] GaAs substrate). The intermediate bandwidth vs the vertical interdot separation is presented. For some suitable interedot separation, the absorption coefficients are calculated for valence band to intermediate band, Intermediate band to conduction band transitions. [C126]

"Nanostructured TiO2 and ZnO solar cells using CdS as sensitizer: Stability investigation"

Exploring quantum dots or nano-sized particles of CdS as an alternative sensitizer for organic dye in dye sensitized solar cells have attracted great interest due to the high cost and the UV instability of the organic dye. In this work, a 2.46% (Voc=0.69 V, Jsc= 6.54 mA/cm2, F.F. = 0.55) CdS sensitized nanoparticle TiO2solar cell is

achieved under AM 1.5. The control sample of N3 dye sensitized TiO2solar cell has efficiency of 7.88%. However, the CdS sensitized TiO2cell degrades rapidly even under dark environment. Replacing TiO2with ZnO can increase the CdS sensitized solar cell stability. In addition, a solid state CdS sensitized DSSC is fabricated as another approach to improve cell stability. [C127]

"Improved light trapping structure for monocrystalline silicon solar cells"

We investigated novel surface treatment and its impact on silicon photovoltaic cells. Using 2-step etching methods, we have changed the nanostructure on pyramid surface so that less light is reflected. In addition, it has been shown that carrier lifetime through the process optimization was not degraded. The results of this experiment represent a promising guideline for improving the high-efficiency solar cells by introducing sub-texturing process. [C128]

"Enhanced angular response of power conversion efficiency for silicon solar cells utilizing a uniformly distributed nano-whisker medium"

In the research of photovoltaic devices, eliminating Fresnel reflection loss is a critical issue on the way to pursue higher efficiency. To maximize the power conversion efficiency, dielectric antireflective coating shows a cost-effective approach, but not enough to absorb broadband solar radiation effectively. Recently, the functional nanostructure shows high potential to be an omnidirectional antireflective coating for the photovoltaic devices. Here we demonstrate Indium-Tin-Oxide (ITO) nano-whiskers, grown by the self-catalyst vapor-liquid-solid (VLS) mechanisms on the textured Si substrate. The ITO nano-whiskers can provide broadband anti-reflective properties (R<;5%) in the wavelength range of 350-1100nm. In comparison with conventional Si solar cell, the ITO nano-whiskers coating solar cell shows higher external quantum efficiency (EQE) in the range of 700-1100nm. Moreover, the ITO nano-whisker coating Si solar cell shows a high total efficiency increase of 1.1% (from 16.08% to 17.18%). The angular response of the conversion efficiency also increases from 7% at the normal incidence to more than 15% for incident angles over 70°. [C129]

"ZnO-ZnTe nanocone heterojunctions for efficient carrier transport for photovoltaic conversion"

Vertically aligned ZnO nanocones were synthesized as cores by utilizing the growth rate difference between terrace and edge sites of nucleation domain during thermal vapor deposition. The p-n junctions were formed by subsequent growth of ZnTe as shells on the nanocone surface using PLD. The polycrystalline structures were observed for ZnTe shells, while the wurzite structure was shown for ZnO cores. Typical I-V characteristics of p-n junction were obtained for the nanocone core-shell structure, but not for the nanorod structure. These structural and electric characteristics indicate that ZnO nanocones are more feasible than ZnO nanorods as practical heterojunctions because the sloping facets of the nanocones facilitate deposition of ZnTe by PLD without the deleterious effects of shadowing. Furthermore, based on theoretical modeling of nanostructure heterojunctions, the nanocone-based junction exhibits an electrostatic potential profile that is much more effective for carrier transport than the electrostatic potential for the nanorod-based junction. [C130]

"High S/N crystallinity measurement and effective defect passivation in silicon nanostructures for third generation photovoltaics"

For application of Si nanostructures to third generation photovoltaics, high S/N measurement of Si crystallinity and effective defect passivation method have been investigated. Here we use Si/SiO2multiple quantum wells as an example of nanostructure, and show that attenuated total reflectance FTIR (ATR-FTIR) spectroscopy can be applied to detect crystallization of Si with high sensitivity based on the dependence of silicon-hydrogen absorbance peaks on Si crystal face. ATR-FTIR technique, which probes the very surface of samples, was found to be more sensitive to crystallization than Raman spectroscopy. We also show that high-temperature hydrogen annealing is an effective defect passivation method. In particular, the effectiveness of passivation of E' center in SiO2, which is essential to the solar cells involving tunneling through SiO2, was demonstrated. [C131]

"Frequency-dependent resonance phenomena in 3D-nanostructure composed of nickel-zinc ferrite particles embedded in opal matrix and their application"

Microwave properties of magnetic photonic crystals, namely, silica opal matrices with embedded nickel-zinc iron spinel nanoparticles have been investigated in the frequency range from 26 to 38 GHz. The experiments were carried out using electromagnetic wave penetration through a sample placed into a waveguide and reflection of the wave. It has been found that these magnetic nanocomposites show giant "antiresonance"-type and resonance-type dependences of the reflection coefficient versus magnetic field. Magnetic resonance and "antiresonance" spectra have been studied. Variation of the reflection coefficient under "antiresonance" condition

exceeds 150% that enables to use that material in magnetic field driven devices of millimeter waveband. [C132]

"Ab initio model of carbon nanotubes growth on nano-structured Ni catalyst in a nanoporous Al2 O3 membrane and resistance calculations for their junctions with various metal substrates"

We consider the carbon nanotube growth in nanoporous alumina membranes comparing the results of ab initio simulations performed on 2D periodic models of C/Ni(111) and C/θ-Al2O3(010) nanostructures. Our results predict a quite effective and reproducible growth of carbon nanotubes upon the nickel nanostructured substrate. In absence of catalyst nanoparticles upon the bottom of the nanopores inside alumina membrane, the carbon structures could grow from the walls towards the centers of nanopores, yielding either carbon nanoscrolls or rather thick amorphous (soot-like) microtubes. We also consider the junctions of carbon nanotubes with contacting metallic elements of a nanocircuit, carrying out numerical simulations on the contacts resistance, using multiple scattering theory and the effective media cluster approach. Calculations for different multiwalled nanotube-metal contacts yield quantitatively realistic results, from several to hundreds kOhm, depending on nanotube chirality, diameter and thickness. As an indicator of possible `radial current' losses we also report on the simulation of the multiwalled nanotube inter-wall transparency coefficient. [C133]

"Monolithic integrated antennas and nanoantennas for wireless sensors and for wireless intrachip and interchip communication"

Monolithic integrated antennas and nanoantennas based on silicon technology, carbon nanotubes, graphene, and nanostructure thin film technology are discussed. Monolithic integration of antennas and novel nanoelectronic devices yields interesting applications in wireless sensing and in wireless intrachip and interchip communication. In case of extreme miniaturization the electronic properties of the materials used in the antenna antenna structures yield interesting effects like slow-wave propagation. [C134]

"Computational optoelectronics as analysis and design tool"

This paper gives an overview of physics-based modeling of semiconductor optoelectronic devices, which are key components in fields such as photovoltaics, solid-state lighting, communications and sensing. Despite this broad application range, some common underlying theory can be identified: accurate modeling of light-matter interaction, semi-coherent carrier transport in nanostructures, accurate calculation of electromagnetic characteristics. In this contribution, a selection of models and devices are discussed and their applicability for analysis purposes is demonstrated. [C135]

"Photo emission spectroscopy for Ag-TCNQ (TCNQ = tetracyanoquinodimethane) nanowires"

The electrical conductivity of many TCNQ charge-transfer complexes generated much interest in the subject of field emission displays (FEDs). Ag-TCNQ nanowires were prepared using a vacuum vapor-transport reaction method at a lower temperature, showing good field emission properties in our previous work. In this work, XPS test was carried out using the VG Scienctific suface analysis instrument (XR5 type) to study the charge transfer. Low energy resolution spectra were obtained by illuminating the sample with standard Al Kα radiation(hv =1486. 6 eV). UPS test was done on the instrument of VG ADES-400 type, with illumination of He I line(hv = 21. 2 eV). Results from XPS test for those nanowires showed that the charge transfer between the electron donor and acceptor was not complete in accord with the Raman analysis. The work function of the nanowires was measured by the ultraviolet photoemission spectroscopy (UPS) with the threshold energy method. UPS analysis showed that the highest of state occupied is 0.78 eV below the Femi level and the work function is about 5. 45 eV, which is different from the effective work function of 1.77 eV estimated by the Fowler-Nordheim plot in this theory. The nanostructure of organic nanowires and the special electrical conductivity by the charge transfer process are attributed to the good field emission properly. [C136]

"Phenomenological model of the field induced electron emission from a 2D nanoheterostructured surfaces of a kind: A conductor-a thin dielectric film"

The author presents a phenomenological model of field-induced electron emission in a 2D nanostructure composed of a metal-dielectric thin film interface in a vacuum, under a homogeneous electrostatid field. [C137]

"Glucose sensor using the one dimensional nanostructures"

Glucose detection is of great interests with many applications ranging from clinical diagnosis to environment monitoring. One dimensional nanostructure such as ZnO nanostructures and carbon nanotubes provide promising matrix for the fabrication of glucose sensor due to their unique advantages including the high specific surface area, non-toxicity, chemical stability, electrochemical activity and high electron communication features.

In this work, we will first introduce our study on amperometric glucose biosensors which were constructed using the ZnO nanostructures as supporting materials for enzyme (GOX) loading. A high sensitivity (15.33 μA/cm 2.mM) and high affinity of GOXto glucose as well as the low detection limit (0.02 mM) of the glucose sensor were achieved. [C138]

"Nanostructured carbon electrodes for energy storage"

Current work on using nanostructured carbon surfaces in supercapacitors and batteries to enable enhanced performance is discussed. The emphasis is on solid electrolyte based batteries and supercapacitors which can be flexible and change form factor. This is a new concept for energy storage systems driven by the requirements of next generation mobile communication devices which will be designed to supplement regular battery power with power from harvested energy. It will be shown that a new class of flexible supercapacitors and batteries can be realised through use of carbon electrodes with enhanced nanostructure. In particular Carbon nanohons (CNH) are considered. CNHs are formed in 'crushed' or 'origami -like' graphene sheets. They form into 10 -50 nm diameter particles with a high degree of open pores having high surface area and permeability. The variable spacing between 5nm -lnm of two graphene sheets in CNH introduces a new surface energy regime for intercollation of ions. Results from applying CNH in electrodes in supercapacitors and batteries are presented. The power density of a flexible supercapacitor, for example, can be increased very significantly by designing nanostructure into the carbon electrodes. The devices under consideration are aimed at powering mobile electronic and autonomous sensing systems. However, the potential of scaling of the technology to larger energy storage systems is viable. [C139]

"Real time RHEED evaluation with the help of image processing"

In this paper, the reflection high-energy electron diffraction (RHEED) pattern during the nano structure formation with the help of image processing is investigated. Nowadays, the growth of self-organised nano structures has been intensively investigated. It is very important to understand their growth process and the knowledge about their shape is particularly significant. The growth of these nano structures can be tracked in-situ manner with the help of RHEED. In-situ information about the stage of the process and the shape of the structure has been provided by RHEED. The temporal relation between the formation of the nano structure and the RHEED pattern is rather complicate. The image processing of the RHEED pattern help us to recognize and to interpret the metamorposis of the pattern during the growth process. [C140]

"Shaping the nanostructures from electromigration-based deposition"

Electromigration-based deposition (EMBD) is proposed for the fabrication of three-dimensional (3D) metallic nanostructures. The process is based on nanofluidic mass delivery at the attogram scale from metal-filled carbon nanotubes (m@CNTs) using nanorobotic manipulation inside a transmission electron microscope. By attaching a conductive probe to the sidewall of the CNT, it has been shown that mass flow can be achieved regardless the conductivity of the object surface. Experiments have also shown the influence of heat sinks on the geometries of the deposits from EMBD. By modulating the relative position between the deposit and the heat sinks, it becomes possible to reshape the deposits. As a general-purposed nanofabrication process, EMBD will enable a variety of applications such as nanorobotic arc welding and assembly, nanoelectrodes direct writing, and nanoscale metallurgy. [C141]

"Fabrication of large-area PDMS triangle nanopillar arrays"

This paper presents an approach for fabricating periodic triangle nanopillar arrays by a combination of bilayer self-assembly, oxygen etching and poly (dimethylsiloxane) (PDMS) moulding. A bilayer of polystyrene (PS) nanospheres is used on a substrate as a template for replicating the PDMS nanostructure. The gaps in nanoscale is tuned by reducing the diameter of the top layer nanospheres using oxygen etching. Good uniformity is observed in the triangle structures. The feature size of the triangle structures can be tuned by controlling the etching time. The simplicity and low cost of this approach may make widespread applications of these PDMS nanopatterns. [C142]

"3-dimensional spintronics"

A new magnetic quasi-particle called a chiral soliton is described in multilayered magnetic nanostructures. This quasi-particle exhibits many of the features exhibit by domain walls but is better suited to 3-dimensional device architectures. [C143]

"Simulation of optical waves in thin-film solar cells"

In order to increase the efficiency of thin-film solar cells, the nanostructure of these cells has to be optimized. To this end, simulations of the optical wave in thin-film solar cells are required. The frequency dependence of the refraction index of materials, like amorphous silicon (a-Si:H), cannot be described by dispersive models like Drude model. Therefore, single frequency simulations for the whole solar spectrum have to be performed. To discretize materials with negative permittivity efficiently, we developed a new finite-difference-frequency-domain method to avoid computationally intensive simulations. To demonstrate the efficiency of our method, we present 3-dimensional simulations for a tandem solar cell including interfaces described by AFM-scans. Plasmonic effects at the silver back-contact show the efficiency of our discretization in case of materials with negative permittivity. [C144]

"Carbon nanocages templated by gold nanostructures"

Summary form only given. Hollow nanocages are useful in many applications including catalyst support, batteries and drug delivery. Several systems have been pursued to produce nanocages, but for carbon, studied cages are mainly smaller ones, like fullerenes. Attempts to make larger carbon nanocages are more limited, resulting in foam-like structures with relatively thick walls or by methods that do not easily get controllable sizes. For applications of nanocages there are needs for methods that allow carbon cages to be fabricated with determined size and shape. Here, we report on a new method to grow large carbon cages, using gold nanoparticles on carbon nanotubes as templates (Figure 1). The experiments were done inside a TEM using a special in-situ holder, called TEMSTM, with movable electrical probes, allowing a detailed observation and control of the entire process. The cages were grown on the nanoparticles under electrical Joule heating and the gold were subsequently evaporated, leaving the cages intact. The templating gold nanoparticles could be made in different sizes allowing size adjustments of the resulting carbon nanocages. The obtained cages may have wide applications including drug delivery and hydrogen storage. [C145]

"Graphene as the electrode material in supercapacitors"

Supercapacitors, a new energy storage element based on electrochemical double layer capacitance, store energy by ion adsorption, have recently attracted increasing interest with the sharp development of nanostructure materials. Supercapacitors store and release energy by nanoscopic charge separation at the interface between an electrode and an electrolyte, and the energy restored in it is inversely proportional to the thickness of the double layer. Due to its high power density, long cycle life, low weight, flexible packaging and a wide thermal operating range compared to other conventional energy storage devices, supercapacitor can be used as a potential energy device bridging the gap between chemical power and common electrostatic capacitance. However, a distinct defect for supercapacitor is the energy density lower than rechargeable batteries. Electrode material is the key to improve the performance of supercapacitor, so most of researches current is around searching electrode materials with higher specific capacitance. Fortunately, graphene as a single atomic of graphite was found to be suitable for electrode materials in supercapacitors owing to its super conductivity and high specific area. In this paper, we report a study on graphene as the electrode material in supercapacitor. [C146]

"Field emission properties of AlN nanostructures"

Herein, a simple approach through vapor transport and condensation process for the synthesis of various large-scale AlN nanostructures has been demonstrated using AlCl3powder and NH3as starting materials. Their structural and field emission (FE) properties were characterized. The nanostructure dependences of FE properties and the possible mechanism involved have been investigated and discussed. [C147]

"Fabrication of patterned aligned W18 O49 nanowire arrays with high field emission performances"

Intensive investigation on WO3-xnanostructures has been carried out in the last decade because they possess extraordinary properties. Especially for application in field emission, W18O49nanostructures have exhibited excellent performance. Some issues have to be addressed in fabricating vacuum microelectronic devices using W18O49nanostructures, including how to realize well aligned nanostructure arrays with uniform phase and selected-area growth. Therefore, developing new approaches to synthesize patterned W18O49nanostructure arrays is very necessary. Here, we report the controlled growth of patterned and aligned W18O49nanowires by a simple lift-off technique. [C148]

"Photovoltaic properties of Si nanostructure based solar cells fabricated on quartz"

Solar cells with different silicon nanostructures have been fabricated on quartz wafers. A correlation between their photovoltaic properties and the conductivity was clearly found. The best results are achieved for amorphous silicon based nanostructures. [C149]

"Carbon material-based nanopatterns and nanostructures: Synthesis, characterization and applications"

Summary form only given. In this talk, I will summarize the recent research on carbon nanotubes (CNTs) and graphene-related materials done in my group. It includes the dip-pen nanolithography-based controlled fabrication of CNT arrays on solid substrates, "needle-scratching" method based fabrication of large-area catalyst patterns used for growth of ultralong (0.5 mm) and high density single-walled CNTs (10 tubes/μm), synthesis of grapheme derivative-based materials, and the graphene derivative-based chemical and bio-sensing, solar cells, devices and cell cultures. [C150]

"Controlled synthesis of one-dimensional titania nanostructure films on transparent conductive glasses from a heterogeneous solvothermal method"

In this paper, we report on the synthesis of 1D TiO2nanostructure films on fluorine-doped tin oxide (FTO) substrates via an interface reaction of nonpolar solvent and hydrophilic FTO glass substrate under solvothermal conditions. [C151]

"CMOS Nanostructures with Improved Temperature Behavior Using Double Differential Structures"

An original 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 linear and superior-order curvature corrections. The superior-order curvature-correction is achieved 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 PTAT2. The SPICE simulations confirm the theoretical estimated results, showing a temperature coefficient under 11 ppm/K for an extended input range 223 K < T < 423 K and for a supply voltage of 1.8 V and a current consumption of about 1 muA results. [C152]

"Vapor-liquid-solid growth of ZnO nanostructure"

In our research we focused on one of methods how to create nanostructure of single crystal of zinc oxide (ZnO). Chosen method was vapor-liquid-solid method. With this method the well aligned wires of single crystal of ZnO can be created on different substrates. In our case we used silicon, sapphire, silica glass and ordinary glass used in laboratory (slide). There are two kinds of morphology of these nanowires. They can be perpendicular to the surface or can have mismatch structure. The ordering strongly depends on the type of substrate-on it crystal system. Perpendicular ones were reached on sapphire substrate, with mismatch structure on silicon and silica glass. No zinc oxide nanowires grown on ordinary glass for laboratory purpose. The length of the wires was from 5 mum to 20 mum. The diameter was from 50 nm to hundreds of nm. [C153]

"Ultrafast optical nonlinearities in hybrid metal-J-aggregate nanostructures"

The strong coupling between excitons and surface plasmon polaritons (SPP) in metal-semiconductor and metal-dye nanostructures are interesting because in analogy to semiconductor microcavities may be of importance in designing novel nano-optic devices. So far, however, very little is known about such nonlinearities and rather weak effects have been observed. This paper reports on the first observation of ultrafast optical nonlinearities in metal-J-aggregate hybrid nanostructures. Results demonstrate that the strong coupling between surface plasmon polaritons and excitons drastically alters the polariton dynamics. A metal-J-aggregate, hybrid nanostructure consisting of an aggregated cyanine dye-polymer film on a gold grating, is investigated. Strong, linear exciton-SPP coupling in these nanostructures is verified by angle-resolved, p-polarized reflectivity measurements, revealing significant bending due to the SPP-exciton polariton formation. These linear spectra are well understood within a coupled oscillator model with a coupling strength of ~20 meV. Near SPP resonances, strong polariton nonlinearity is observed, having a dispersive lineshape even at probe wavelengths which are strongly detuned from the exciton-SPP crossing, accompanied by significant changes in the dynamics of the polariton nonlinearity. [C154]

"Ultrafast coherent control of nonlinear optical processes in plasmonic nanostructures"

We present a new technique to coherently control ultrafast nonlinear processes in a plasmonic nanostructure on a femtosecond timescale. By using a four-photon process our detection provides full information about the coherence in the system. [C155]

"Nanorod light emitting diode arrays with highly concentrated radiation profile and strain relaxed structure"

We have developed a natural lithography method to fabricate nanorod structure. The spin-on glass is used as a space layer to realize the nanorod LED. The strain is released in nanorod structured LED which is indicated by their nearly constant electroluminescent peak wavelength at the injection current range between 25 mA and 100 mA. Furthermore, a highly concentrated radiation profile is observed from the nanorod LED array. We suggest a light guided concept to explain the narrow radiation phenomena. [C156]

"MEMS to the healthcare technology with robots inserts-A methodological approach"

The MEMS (microelectromechanical systems) technology; has been scaled down to submicron dimensions, and has been integrated with nanometer-scale tips; and deep submicron moving transistors. Integrated nanostructure mechanisms add a new dimension to mesoscopic physics, microinstruments, microsensors, and microactuators. The fabrication and operation of movable, integrated nanostructure mechanisms that produce nm-scale, precision motion are examined. Self-supporting, movable using single-crystal silicon springs and electric-field drive structures with integrated, movable field emission and tunneling tips are possible. Movable mechanical structures with cross-sectional dimensions of 150 nmЧ1000 nm have been fabricated using single-crystal silicon. The nanofabrication process includes high-resolution e-beam and optical lithographies, anisotropic reactive ion etching, and selective oxidation of silicon. Large, dense arrays of 10-20-nm-diameter tips for field emission electron microscopes or scanned-probe applications have been fabricated using these processes. [C157]

"FDTD study on the improvement of optical transmission through metallic periodic nano structure"

Owing to reflection, photons generated in semiconductor light emitting devices are trapped inside core region; we found the implement of metallic periodic nano structure might contribute to their extraction and demonstrated it in FDTD simulation. [C158]

"Electron field emission from wide band-gap semiconductors (GaN)"

In order to explain the obtained experimental results on electron field emission from nanostructured surfaces of GaN, a model was proposed taking into account the changing of carrier concentration distribution in the main and the satellite valley during the emission process. The lowering of work function (due to the increased number of carriers in the satellite valley) can explain the decrease of the F-N plot slope. In case of n-type doped GaN the lowering of work function can be caused by electron transition from the main valley (Gamma) to upper satellite valley (X) due to the heating in high electric fields. The nanostructured surfaces of GaN have nanometer tip diameter (d<10 nm). Under such circumstances the quantum size confinement effect causes the energy band reconstruction. It was shown that the energy difference between the main and satellite valley in GaN was decreased in case of quantum confinement, thus increasing the probability of electron transition from Gamma to X valley at same electric fields. [C159]

"Eccentric coaxial gap-plasmon aperture arrays for enhanced extraordinary optical transmission and applications"

The eccentric coaxial metal waveguide is similar to concentric coaxial structure, which has been studied extensively in the plasmonics community. Compared to the concentric structure, the eccentric structure has many benefits, including: (1)stronger subwavelength field localization around the narrowest gap, (2) improved optical coupling to the lowest order mode due to linear polarization, and (3) an increased effective index due to the gap plasmon. Yet, there have been no reports on the plasmonic aspects of this structure so far. This paper investigates on focussed-ion beam fabricated arrays of eccentric coaxial structures. An effective index method is used to analyze the field localization and enhancement. The gap plasmon is assumed dominant over conformal effects which can play an important role. Results show that the analytic theory agrees very well with a commercially-available finite-difference mode-solver(FDMS). Based on the simulations, strong modification to the extraordinary optical transmission peak is expected, with increased transmission over the concentric coaxial and cylindrical structures. [C160]

"Laser fabrication of nonlinear and metallic photonic nanostructures"

The paper presents the investigations into the fabrication of photonic structures by direct laser-writing and nanoimprint lithography using organic-inorganic hybrid materials that have: (i) nonlinear optical properties and (ii) can be selectively covered with metal. Direct laser-writing by two-photon polymerization (2PP) allows the fabrication of three-dimensional (3D) structures with a resolution beyond the diffraction limit. The polymerization process is initiated when the beam of an ultra-fast infrared laser is tightly focused into the volume of a

transparent, photosensitive material. The technique has been employed successfully in the fabrication of nanophotonic structures and devices. [C161]

"High speed fabrication of periodical nanostructures by fs-laser direct writing on surfaces and in the volume of transparent materials"

Using fs-laser direct writing periodical surface nanostructures are fabricated on the surface of dielectric materials. By using high repetition rate fs-laser radiation with a wavelength of 1045 nm periodical nanostructures with periods of 200-350 nm are obtained on dielectrics. In this paper the pump-probe technique is used for time-resolved investigations of the spectral reflectivity and transmittivity during and up to 1 ns after the fs-laser pulse. From this measurements the transient electron density in the conduction band and the transient dielectric function are calculated and used to extend the classical ripples theory with the transiently modified dielectric function. The periods of the surface nanostructures are compared to the calculations and discussed. [C162]

"Filling of slot waveguides with Atomic Layer Deposition"

Slot waveguides are promising new nanostructures for confining light in low-index materials. Atomic layer deposition (ALD) could be a very suitable method to fill vertical slot waveguides with inorganic materials. Intel has the ALD technology already in production in its new high-k silicon technology, so it would be a natural choice for enabling the integration of photonic components on the same chips. [C163]

"Field emission performance of nanostructured carbon films"

The field emission performance of n-type NCD films with different composition and nanostructure is investigated in detail by analyzing the different role played by composition, grain size and orientation in the attempt to identify the material better suited for cold emitters realization in terms of low voltage operation, current driving capability and stability. Different configurations of collecting electrodes are employed to verify the occurrence of nitrogen induced morphology changes and partial orientation into elongated in plane diamond domains. By increasing nitrogen content up to N2=25% the threshold field for an electron emission current density of 1 muA/mm decreases from 25 V mum-1down to 11 V mum-1. In addition, by comparing the field emission performance achieved for the sample with N2= 25% using planar and vertical electrode arrangements, a further reduction of threshold electric field from 11 to 7.5 V mum-1and much higher emission current density (up to 50 mA/cm2) are found, without showing fatigue effects after prolonged emission. Thanks to the composition and to the orientation of carbon emission sites, the N2= 25% UNCD film then appears the elective material for the realization of stable cold cathodes. [C164]

"Synthesis and field emission property of tetrapod-like zinc oxide nanostructures by inductive heating"

Inductive heating method was used to synthesis regular tetrapod-like zinc oxide within 1 minute in the air. The synthesis of the nanostructure was interpreted by the Vapor-Solid (VS) growth mechanism. The nanostructure was verified to be pure ZnO nanostructure by X-ray diffraction (XRD) spectrum. Field emission measurement was applied to prove that it owns low turn-on field and large emission current. Tetrapod-like ZnO nanostructures synthesized in our method are technologically useful for vacuum electron devices because they could be synthesized sufficiently and rapidly in a room temperature. [C165]

"Field emission property improved by ZnO acicular nanostructure through chemical bath deposition"

ZnO acicular nanostructure was designed and grown from aqueous solution on the conductive substrate. The diameter of ZnO was 50 nm and length was about 5 mum. due to the large aspect ratio, the as-prepare ZnO sample was applied in filed emission with turn-on electric intensity of 3.2 V/mum and enhancement factor beta of 2830. [C166]

"Ultrafast relaxation dynamics in GaN nanowires"

Time-resolved optical measurements on GaN nanowires give insight into carrier relaxation dynamics on a femtosecond timescale, allowing us to understand the nature of defect states present in the nanostructure. [C167]

"Two-photon fabrication of three-dimensional metamaterials"

Two-photon-induced metal ion reduction technique is developed for fabricating 3D metallic micro/nano structures.

The fabrication of continuous and electrically conductive silver structures with a minimum width of 100 nm are demonstrated. Moreover, the realization of self-supporting 3D silver microstructures is demonstrated. This technique will become a promising tool for realizing three-dimensional plasmonic metamaterials. [C168]

"EUV detection of high-frequency surface acoustic waves"

We use coherent extreme ultraviolet radiation to probe surface acoustic wave propagation in nickel-on-sapphire nanostructures. We observe no acoustic dispersion over SAW wavelengths down to 200 nm, meaning the SAW propagation is unaffected by the nanostructure. [C169]

"Few-femtosecond electronic dephasing of an individual plasmonic nanostructure using interferometric FROG"

Frequency resolved optical gating (FROG) using ~10 fs laser pulses is adopted to probe the response function of individual plasmonic nanostructures. Using symmetry-selective second-harmonic scattering we deduce the associated ultrafast electronic dephasing of several femtoseconds. [C170]

"Achieving resolution far beyond the diffraction limit with RAPID photolithography"

A method to scale the resolution in photolithographic fabrication is introduced, in which one laser beam is used to initiate multiphoton absorption polymerization in a negative-tone photoresist while a second, phase-shaped laser beam is used to deactivate the polymerization. This approach allows for fabrication of polymeric nanostructures with lambda/20 resolution. [C171]

"Organic electro-optic single-crystalline waveguide modulators, microresonators and nanowires fabricated by melt capillary growth"

We developed a new approach to fabricate high-quality single-crystalline high-index-contrast waveguiding micro- and nanostructures and demonstrated electro-optic modulation at 1.55 mum in waveguides grown from the melt of a recently developed organic material. [C172]

"Measuring angular dependent effective properties of metamaterials"

We measure the angular dependent response of a Swiss-cross metamaterial that has an effective index of n=-1.9 at normal incidence. It is experimentally shown how the effective properties depend on the incidence angle. [C173]

"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. [C174]

"Spinoptics: Dynamics of spinning light in nanoscale-structure"

Observation of optical spin-Hall effect that appears when a wave carrying spin angular momentum interacts with plasmonic nanostructures is presented. The measurements verify the geometric phase, demonstrated by the spin-dependent deflection of the surface waves. [C175]

"Self-assembled metal nanocluster metamaterials"

A bottom-up approach based on template-directed colloidal self-assembly was used for fabricating metal nanocluster based matematerials and their optical properties were studied experimentally. Negative index material composed of nanoclusters and metal wires was numerically demonstrated. [C176]

"Ultrafast switching of nanostructure in fused silica"

Femtosecond switching of anisotropic nanostructure indicating birefringence with a time constant of plusmnb200 fs was observed. Such anisotropy has evolved by lowering threshold for defect formation and enhanced coherency of the electron plasma wave. [C177]

"Optofluidic assembly of red/blue/green semiconductor nanowires"

A full-color pixel consisting of CdSe, ZnO, and CdS nanowires has been heterogeneously integrated on a

substrate with lithographic accuracy using lateral optoelectronic tweezers (LOET). Red (CdSe, 685 nm), blue (CdS, 496 nm), and green (ZnO, 518 nm) light emissions are obtained by selectively pumping the corresponding nanowires. Potentially the nanowires can be directly assembled on CMOS driver circuit for a low-power display. [C178]

"Stereometamaterials"

We introduce a novel concept to nano-photonics, namely stereometamaterials. Specifically, we study stacked twisted split-ring resonator metamaterials and demonstrate how their optical properties depend on the particular arrangement of the individual constituents. [C179]

"Dispersion-flattened holey fiber with an ultra-small mode area using a high index slot structure"

A holey fiber design with a high index nanostructure that can achieve an effective mode area not in excess of 0.3 mum2and a flat dispersion at the 1.55 mum band is proposed and studied. [C180]

"Plasmonic-coupled nanostructure for improved surface plasmon resonance biosensing"

A three-dimensional (3D) composite nanostructure with enhanced normal electrical field is simulated and fabricated for surface plasmon resonance (SPR) biosensing. The device is used to measure specific binding events of different proteins. [C181]

"Near-field imaging spectroscopy of low density InAs/InP quantum dots"

Low-density InAs quantum dots (QDs) on an InP(001) substrate were grown by solid source molecular beam epitaxy applying both ripening process and double-cap method. Near-field imaging spectroscopy of these diluted QDs were performed at 10 K. We show this technique has ability to reveal the photoluminescence properties of each single QD. Furthermore, formation of three-dimensional nanostructures between QDs can be predicted in the QDs sample from our results. [C182]

"Strength properties of light-cured dental restorative composites"

The compressive strength of dental restorative composites was studied in this research. Cylindrical specimens were made according to manufacturers' recommendations and stored for two weeks in distilled water at 37degC. Compressive strength was measured using a mechanical test machine with a cross-head speed of 0.5 mm/min; then, acquired data were analyzed using ANOVA and Weibull statistics. Among the studied composites, FiltekregZ350 exhibited the highest compressive fracture strength which could be due to its filler fraction and proper combination of aggregated zirconia/silica cluster fillers in a uniform nanostructure. [C183]

"Fabrication of patterned array of alumina-metal coaxial nanorods"

In this research, a novel template based approach for the fabrication of patterned array of alumina/metal coaxial nanorods was investigated. The orderly uneven barrier-layer surface of an anodic aluminum oxide (AAO) membrane was used as a template. The thickness of the barrier-layer was reduced by phosphoric acid etching. Following, the desired pattern was transferred to the barrier-layer by photolithographic process. A thin Au film was deposited on the photolithographic patterned barrier-layer surface by evaporation as the electrode for further electrodepositing. Nickel nanorods were electrodeposited into the nanochannels at the patterned area. Phosphoric acid was then used to gradually etch off the alumina at the unpatterned area to form a patterned nanostructure of bundles of alumina/metal coaxial nanorods. [C184]

"Near field probes from photonic crystal fibers: proposal and analysis"

Nano-structured PCFs are suggested to use as super-resolving near-field probes. It is shown that the contrast and resolution of these probes are increased with the size and complexity of the PCF nanostructure. [C185]

"SPICE-based approach for magnetic memory simulation"

Original approach to MRAM I-V characteristics simulation by using SPICE-like simulator was presented. An electrical macromodel of MRAM cell based of spin dependent transport tunneling processes in ferromagnetic/insulator/semiconductor nanostructures accounting for defects in the insulator and at its interfaces was realized within Verilog-AMS computer language and used for simulation of the memory devices with CAD software. [C186]

"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. [C187]

"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 driver 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. [C188]

"Electron Beam Stimulated Oxidation of Carbon (EBSOC)"

The patterning of carbon nanostructures by electron beam stimulated oxidation is described. Sputter deposited carbon thin films and carbon nanotubes are locally oxidized in a scanning electron microscope using injected water vapor. The resulting structures are examined with scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Electrical resistance obtained post-processing is comparable to as-deposited values. Etched linewidths on the order of 20 nm are demonstrated along with sub-2 nm wide carbon wires. [C189]

"Design and Simulation of a Novel Nano Structure Quantum Well Voltage Regulator to have a Lower Regulated Voltage"

In this paper we present a novel nano structure quantum well voltage regulator (QWVR) to regulate a voltage in very low voltages, that can be used in low voltage and low power IC's. This structure is based on the double electron layer tunneling transistor (DELTT). We used the depletion mode MOSFET in series with the DELTT and before it to eliminate higher states of resonant tunneling current. Simulation results show that the voltage regulation is occurred around 0.3 v. A desired regulated voltage is obtained with a specific value of the thickness and the concenturation of the GaAs and the AlGaAs epilayers. To simulating the proposed structure, the stationary viscous quantum hydrodynamic model has been used. [C190]

"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 PTAT2. 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 uA. [C191]

"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. [C192]

"Synthesis of Ordered Polymer Micro and Nanostructures Via Porous Templates"

The deposition of specific materials into ordered pores arranged in a regular lattice allows the fabrication of ordered fiber arrays. Polymer micro- and nanofibers using macroporous silicon and nanoporous alumina templates were fabricated employing a vacuum infiltration method for Poly(methyl methacrylate) (PMMA) structures or a melt-assisted template wetting into the pores for Poly(3-hexylthiophene) (P3HT) structures. We have studied how the aspect ratio of the micro- and nanopores and the kind of polymer influence the structures fabrication. [C193]

"Nanostructure-Enhanced Fiber-Optic Interferometry for Label-Free Immune Sensing"

This paper proposes a nanostructure-enhanced fiber-optic interferometry (NSFOI) biosensor, combining the abilities of high sensitivity, real-time monitoring and in-situ measurement for label-free immunological detection, by employing high-aspect-ratio pillar-like nanostructures on the tip of sensor surface. The nanostructure layer, fabricated by a simple etching process on resonant cavity without mask patterning, was employed not only for the improvement of the detection limit to reach 1 ng/ml for rabbit-IgG (~6.7 pM) due to the increase of the biomolecular binding surface, but also for the enhancement of the optical path length to enlarge the maximum magnitude of fringe shift which was approximated to 1.4 nm by both experimental and theoretical results. [C194]

"Micro Chemical Vapor Deposition System: Design and Verification"

The conventional chemical vapor deposition system has been miniaturized to the micro scale, leading to several potential advantages for the synthesis of nanostructures. First, minute heat capacity leads to fast temperature stabilization. Second, tiny chamber volume helps for rapid gas species exchanges. Third, small Reynolds number ensures laminar flow for better control of deposition sources. Forth, small diffusion length near the chemical reaction surface enhances efficient gas mass transfer. As a demonstration of principle, high-quality single-walled carbon nanotubes (SWNTs) are synthesized while similar experimental parameters in a large scale system fail to construct good quality SWNTs. [C195]

"Modified hard anodization procedure to fabricate hybrid nanoporous alumina"

In this work we present an innovative approach to fabricate new structures based on nanoporous alumina. The fabrication process is carried out following a modified two-step hard anodization process in a 0.3 M oxalic acid solution at 120 V and 0degC. The nanoporous anodic alumina membranes present a hybrid pore structure which consist of pores with short diameters inner pores with longer diameters. This new nanostructure could be used to develop new chemical or biological sensors or to fabricate optoelectronic and storage devices. [C196]

"External electrical and optical effects in the operation of monolithic mode-locked laser diodes and the potential of nanostructure technologies in reducing these effects"

The effects of the electrical parasitics and external optical reflections on the dynamic regimes and spectral properties of Fabry-Perot and Distributed Bragg Reflector monolithic mode-locked laser diodes are investigated numerically. Reduction of the range of stable mode-locking by the screening of the applied electric field by photocarriers accumulated due to the finite absorber circuit response time is investigated. External optical feedback above a certain critical value is shown to affect the laser dynamic drastically, potentially resulting in a wide range of dynamic regimes depending on the external reflector strength and position and in most cases severely degrading the laser performance, in agreement with experimental findings. The potential of some methods of reducing unwanted external electrical and optical effects, including the use of nanostructures such as deep-etched reflectors and Quantum Dot active media, is discussed. [C197]

"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. [C198]

"Manipulation and alignment of silicon carbide nanotubes with AC electric fields"

The manipulation of individual nanostructures, regardless of their shape or medium, is a challenge for those seeking to efficiently utilize the electrical properties of those nanostructures [1]. In this study, two procedures were developed to observe the effects of an AC electric field to manipulate and align silicon carbide (SiC) nanotubes. Although the initial procedure proved to be inconclusive, it revealed the difficulties with manipulating relatively large quantities of nanotubes on a millimeter scale. The second procedure, which utilized electrodes on the micrometer scale, proved to be more successful in manipulating and aligning the SiC nanotubes. It is believed the latter method of manipulating SiC nanotubes can be employed to position individual structures across similar electrodes to measure their electrical characteristics. [C199]

"Anomalous group velocity in a 3D photonic nanostructure"

Experiments have confirmed the existence of both behaviors in three-dimensional ordered nanostructures, in the spectral range where the wavelength of light is on the order, or smaller, than the lattice constant. Using periodic boundary conditions in a band structure calculation of a perfect 3D photonic crystal one finds that, in such frequency range, only propagating modes with a vanishing slope dispersion relation exist and, hence, a reduced group velocity is predicted. In this paper, we study such group velocity behavior for finite thin artificial opal slabs made of a reduced number of layers. In our model extinction is included. The group velocity and group index of the electromagnetic waves from the linear response of the crystal, is determined in the high energy spectral region. [C200]

"Single KTiOPO4 nanocrystals for nonlinear probing of local optical fields and interaction with a metallic nanostructure"

We isolate nonlinear KTiOPO4 (KTP) nanocrystals and study them by second-harmonic generation (SHG) microscopy and atomic force microscopy (AFM). With both polarization analysis and defocused imaging of the emitted second harmonic field, we extract the Euler angles of the crystalline axes of a single nanocrystal. The nonlinear features and photostability of a single KTP nanocrystal make it a good candidate for a vectorial probe of electromagnetic near-fields and coherent imaging. [C201]

"Ultrafast electron-hole dynamics in core/shell CdSe/CdS dot/rod nanocrystals"

Colloidal semiconductor nanocrystals are nanoscale materials whose optical, electronic and transport properties, due to their strong dependence on size and shape, can be finely tuned by advanced chemical synthesis approaches. Among various types of semiconductor nanocrystals, core-shell nanostructures comprised of a semiconductor core that is covered by a thin shell of another type of semiconductor material have been extensively investigated. This paper investigates ultrafast carrier dynamics of core/shell CdSe/CdS dot/rod heterostructures by using femtosecond pump-probe transient spectroscopy in the visible spectral range to analyze. Upon tuning the pump photon energy and intensity, the core or the shell is selectively excited: the electronic structure and the wavefunction distribution at the rod/dot interface and the electron-hole dynamics within the nanostructure have been investigated. Results show that after charge carrier relaxation into the lower energy levels associated to the CdSe dot, the electron wave function extends into the rod: upon exciting the CdSe core an intense bleaching signal in the CdS spectral region is found which is due to the delocalization of the electronic wavefunction on the basis of envelop-function theoretical calculations. [C202]

"Photonic metamaterials: Recent progress"

Complete control of an electromagnetic light wave inside a material requires control of both, its electric and its magnetic component. Metamaterials are man-made effective materials composed of metallic sub-wavelength building blocks ("photonic atoms") that are densely packed into an effective material. Split-ring resonators (SRR) are particularly important "photonic atoms". They can be viewed as tiny LC circuits that can be excited by the incident light field. The incorporation of gain materials appears to be promising and also contains interesting physics. The other major challenge lies in fabricating 3D metal-based metamaterial nanostructures via 3D direct laser writing. [C203]

"Surface-enhanced Raman scattering by CdS quantum dots"

Surface enhanced Raman scattering is studied in nanostructures with CdS quantum dots formed by using the Langmuir-Blodgett technology. Features related to longitudinal optical phonons of quantum dots are observed in the Raman spectra of both free-standing CdS quantum dots and the dots embedded in an organic matrix. Strong enhancement of intensity (about factor of 700) of Raman scattering by free quantum dots is observed by deposition of silver clusters onto the nanostructure surfaces. The dependence of the Raman intensity on the excitation energy is resonant with a maximum at the energy corresponding to the maximal absorption of Ag clusters. [C204]

"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 (mum) 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. [C205]

"Physics-Based Simulation of Carrier Velocity in 2-Dimensional P-Type MOSFET"

The carrier velocity for 2-dimensional (2-D) p-type nanostructure was simulated in this paper. According to the energy band diagram, the effective mass (m*) in the p-type silicon is mostly dominated by heavy hole because of the large gap between heavy hole and light hole in k = 0. The carrier concentration calculation for 2-D, based on the Fermi-Dirac statistic on the order of zero (F0), was applied to obtain the intrinsic velocity of carrier, in the term of thermal velocity vth. The results for 2-D carrier velocity were modeled and simulated, and the comparison for degenerate and non-degenerate regime is presented for various temperature and concentration. It is revealed that the velocity is strongly dependent on concentration and becomes independent of temperature at high concentration. [C206]

"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. [C207]

"Scattering-limited and ballistic transport in nanoelectronic devices"

The fundamental processes on nanoscale that may influence the design of nanoelectronic chips, sensors, and systems is presented. The focus is on the breakdown of Ohm's law in nanoscale devices extensively being used to assess the performance of a ldquosystem-on-a-chip,rdquo may it be for bio, chemical, physical or engineering applications. Novel insights on theories of three sources of transformation of Ohm's law are enumerated: quantum confinement in low-dimensional nanostructures, ballistic transport when conducting channel length is smaller than the mean free path, and high-field initiated carrier asymmetric distribution. The saturation velocity arising from the high-field initiated mobility degradation is shown to be the intrinsic velocity that depends on the nanostructure dimensionality, its carrier concentration, and the ambient temperature, in direct contrast to single number that is quoted in the literature. The ballistic intrinsic velocity is the ultimate saturation velocity that can be lowered by the onset of a quantum emission that may be an optical phonon or photon quantum emitted from an excited quantized level to the ground state. The results presented will have profound impact in the interpretation of data on a variety of nanoelectronic devices and systems that may exist with varying low dimensionality, i. e., classical (analogue energy spectrum) in one or more of the three cartesian directions while other directions go quantum (digitized energy spectrum). [C208]

"Simulated Surface Enhanced Raman Spectroscopy via scattering on a dense, randomly-oriented, array of nanostructures"

This work proposes a set of stochastic experiments that aims to study the surface enhanced Raman spectroscopy (SERS) parameter space in silico. The experimental procedure is modeled as optical scattering on an array of randomly oriented nanoscale dielectric scatterers. A deterministic volume integral equation with a periodic kernel is developed and solved using the method of moments. A Monte Carlo method is also employed to sample solutions of this integral equation for randomly generated configurations of scatterers closely resembling actual SERS substrates. By utilizing these numerical methods, both far- and near-field observables are studied as a function of nanostructure density, alignment, and composition. Field distributions are also shown to represent the preliminary results. [C209]

"The study of a tetrapod-like nanostructure ZnO field emission display"

A tetrapod-like ZnO nanostructures prepared by hyperthermia vapour phase oxidation process were used as the field emission cathode material. The field emission cathode panel prototype is fabricated with ZnO slurry printed and sintered. We packed the cathode panel and the fluorescence panel on which was printed with phosphor power as a 5 inch field emission display of diode structure. The field emission experiments were done and the panel realized stable field emission, it could display simple characters. The turn-on electric field of diode structure ZnO-FED is 1.5 V/mum. When the electric field reaches 5.3 V/mum, the emission current density can approach to 5.11muA/cm2. We had obtained the electric field enhance factor about 6772 by the experiment. It has shown from the experimental results that tetrapod-like ZnO nano-material has good electron emission performance and it is also a beautiful field emission cathode material. [C210]

"Fabrication of Ridge Waveguide Microstructure Using Vacuum-assisted Micromolding Technology"

Limited by light source wavelength and light diffraction, nanostructure fabrication is tough, but it needs multiple special and expensive processes (e.g.: E-beam). The common problems are complex and slow processing, expensive manufacturing equipment and material, and it is very unsuitable for mass production; therefore, itpsilas of utmost importance to develop a nanoscale, high resolution and cost efficient next generation semiconductor process. This study integrated PDMS soft mold, photo resist(SU-8 2035) and vacuum pumping equipment, as well as researched and developed a vacuum-assisted photo resistant microstructure filling technique, and combined soft mold to fabricate waveguide microstructure. Conformal contact was obtained between PDMS soft mold and substrate surface, with low surface free energy, and resistance of sticking to resist in filling.Vacuum equipment was used to enable compact and complete resistant filling, and it can not only greatly increase the effective filling area, but, without residue after filling. There is no need for post treatment removing of the residual layer; it can well lower cost and reduce process time, so that the microstructure component manufacturing technique and application can be more mature. [C211]

"Novel nanobar Pt/ZnO thin films produced by spin-Coating and the effect of annealing on structural and optical properties"

Novel nanobar Pt/ZnO thin films were prepared by the sol-gel technique associated with spin coating onto glass substrates. The as-prepared samples were annealed and characterized by X-ray diffraction (XRD), scanning electron microscope (SEM) and UV-vis absorption spectroscopy (UV-vis). The results indicate that the Pt/ZnO thin films consist of nanobars with diameters about 58 nm. By increasing the annealing temperature from 723 K to 823 K, nanobar is converted to polycrystalline with a hexagonal wurtzite structure with diameters about 75 nm. [C212]

"Fabrication of asymmetric micro- and nanostructure based on stepwise angle-resolved colloidal lithography"

Due to the process simplicity, the low cost, and the accessibility of scaling down the feature size, colloidal lithography has drawn a great deal of attention once being developed. In this work we succeeded in fabricating asymmetric heterogeneous arrays of metallic NPs and asymmetric nanoshells via stepwise angle-resolved colloidal lithography. The present approach is independent of the sphere sizes of colloidal masks and the chemical nature of materials deposited, while it shows a profound dependence on the registry of colloidal masks with respect to the incidence vapor beam and the incidence angle. Such asymmetric heterogeneous arrays and asymmetric nanoshells are hard to construct by otherwise lithographic techniques. [C213]

"Manufacturing pathway and associated challenges for nanoscale computational systems"

We propose one possible manufacturing pathway for realizing nanodevice based computational fabrics that combines self-assembly based techniques with conventional photolithography. This pathway focuses on realizing

the fabric as a whole including assembly of nanostructures, functionalization of devices, contacts and interconnects. Furthermore, this pathway is scalable to large systems, as multiple devices are created simultaneously in a self-aligning process step. We discuss the key sequence of steps for achieving nanoscale computational systems using the example of a simple digital logic circuit, and review the associated challenges involved for each of these. [C214]

"Positioning and numbering Ge quantum dots for effective quantum tunneling devices"

The authors have demonstrated a simple method to precisely control the number and the position of nanometer-scaled Ge quantum dots (QDs) embedded in SiO2or Si3N4tunnel barriers via thermally oxidizing pre-patterned nanostructures. A single Ge QD in the core or twin Ge QDs near the edges of the nanotrench could be realized by modulating the initial nanostructure's dimensions and the spacer's materials. This method offers great promise to realize effective single electron transistors and coupled QD devices for single charge manipulations. [C215]

"Rectangular Hexagonal Mesh Generation for Parametric Modeling"

This paper addresses the problem of rectangular hexagonal mesh generation for surface modeling. Hexagonal grids are important for several applications such as the simulation of carbon nanostructures. A fast and accurate method to obtain a rectangular region over a hexagonal grid is proposed. Strips of hexagons defined by the Hamada indexes are constructed and stacked using a variation of the Bresenham's algorithm. The final hexagonal mesh is tessellated using half-edges in order to be suitable for several operations and simulation processes. This mesh can be used as a parameter space for obtaining different geometric models. Experimental results show that arbitrarily large meshes are generated fast. The enumeration of rectangular regions with high number of hexagons is accurate despite its dimensions. An evaluation of the method under several circumstances is presented indicating its high performance for the generation of a high number of hexagons. [C216]

"Confinement in quantum wire periodic nanostructures"

In this work we calculate the electron band structure of a silicon periodic nanostructure embedded into SiO2and describe the computational implementation we used for this purpose. Further, we discuss the influence of nonparabolicity of electron silicon band structure in the dispersion relation of the periodic nanostructure. [C217]

"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. [C218]

"Characterization of vertically aligned carbon nanofibers grown on Ni dots nanoelectrode array using Atomic Force Microscopy"

One of the major limitations in the development of ultrasensitive electrochemical biosensors based on one-dimensional nanostructure is the difficulty involved with reliably fabricating nanoelectrode arrays (NEAs). In previous work, a simple, robust and scalable wafer-scale fabrication method to produce multiplexed biosensors is introduced. Each sensor chip consists of nine individually addressable arrays that uses electron beam patterned vertically aligned carbon nanofibers (VACNFs) as the sensing element. To ensure nanoelectrode behavior with higher sensitivity, VACNFs were precisely grown on 100 nm Ni dots with 1 Г‚Вїm spacing on each micro pad. However, in order to examine the quality and measure the height and diameter of the VACNFs, some surface detection and measurement tool at the nanoscale level is needed. In this paper, we introduce an approach to measure these nano-scale features through atomic force microscope (AFM). With this method, both the 2D and 3D images of sample surface are generated and the sizes of carbon nanofibers and cavities are obtained. Furthermore, statistical analysis is carried out to enable improvement of VACNFs growth and fabrication. [C219]

"Nano structure carbons for energy storage in lithium oxygen batteries"

In this study, porous carbon aerogels are prepared by polycondensation of resorcinol and formaldehyde catalyzed by sodium carbonate followed by carbonization of the resultant aerogels in an inert atmosphere. Pore

structure of carbon aerogels is adjusted by changing the molar ratio of resorcinol to catalyst during gel preparation and also carbonization under Ar and activation under CO2atmosphere at different temperatures. The prepared carbons are used as active materials in fabrication of composite carbon electrodes. The electrochemical performance of the electrodes has been tested in a Li/O2cell. Through the galvanostatic charge/discharge measurements, it is found that the cell performance (i.e. discharge capacity and discharge voltage) depends on the morphology of carbon and a combined effect of pore volume, pore size and surface area of carbon affects the storage capacity. A Li/O2cell using the carbon with the largest pore volume (2.195 cm3/g) and a wide pore size (14.23 nm) showed a specific capacity of 1290 mA h g-1. [C220]

"Observation of ferroelectric nanostructure by X-ray laser speckle technique"

Polarization domain has long been recognized and interested from early days of ferroelectrics research from application and fundamental point of view. Meanwhile the behavior of the response of nanostructure among the polarization domain at near the phase transition temperature under an external electric field is the vital for the understanding of the high performance of the ferroelectrics. Observation of the polarization domain has been performed by polarization microscope, atomic force microscope, electron microscope, and so on. All these observations by microscopes are static one. Unfortunately, however, it is of no use for the dynamic observation. X-ray photon correlation spectroscopy (XPCS) by synchrotron radiation (SR) is applied to the observation of relaxation phenomena of the nanostructure in matters. Due to the low coherent flux of SR, 0.1% order of total flux, it is difficult to apply the SR XPCS to the fast phenomena with relaxation time faster than 100 musec or so. On the other hands, plasma based soft X-ray laser (SXRL) however 1 second accumulation of SR X-ray photons are contained within its one pulse ,7 psec, coherent flux is over the 90% even with low repetition rate, 0.1 Hz. This is the report of our observation of nanostructure of ferroelectrics by use of SXRL. [C221]

"Logical integrity, fuzzy logic and modeling content of education"

This presentation is about building the model of language in a formal-logical way. The presentation is made of 3 parts. The first one is setting the language's formal-logical-models on Piyajes integrity-logic. The second part is comparing Piyaje's logic with Zade's logic and how the Zade's logic transforms this model. The last part is about what new innovations can be brough by this model. [C222]

"Far field calculations and experimental characterization of nanostructured OLEDs"

We present far field calculations for nanostructured organic light emitting diodes (OLEDs) and compare these to experimental results. OLEDs with a nanostructured indium tin oxide (ITO) anode were fabricated and characterized. Corresponding two-dimensional far field calculations are carried out via two-dimensional finite difference time-domain code (2-D FDTD) with integrated 2-D far-field projection. Furthermore, spherical three-dimensional (3-D) far field calculations are obtained by an efficient multipole-based near-to-far field transformation from three-dimensional FDTD data. [C223]

"High-field initiated ballistic transport in carbon nanotubes"

In this paper, the carrier statistics in the carbon nanotube with nonparabolic energy spectrum was investigated to predict the ultimate (intrinsic) drift velocity using Arora's formalism, as a function of temperature, concentration, and chirality. Quantum emission factor was also explored. Results stated that the quantum emission does not affect the CNT mobility but lowered the saturation velocity. Results on ballistic and scattering-limited transport were also presented in order to identify experimental planning for the correct mechanisms of CNT or graphene nanostructure. [C224]

"Silver nanostructures for plasmonics and nanophotonics"

Silver nanostructures are containers for surface plasmons-the collective oscillation of conduction electrons in phase with incident light. By controlling the shape of the container, one can control the ways in which electrons oscillate, and in turn how the nanostructure scatters light, absorbs light, and enhances local electric fields. With the help of discrete dipole approximation (DDA) calculations, it is possible to understand how shape control can be used to tailor the plasmonic properties of silver nanostructures. The calculated predictions are then validated by experimental measurements performed on nanocubes and nanoplates with controllable corner truncation, as well as nanowires with pentagonal cross-sections. Controlling the shape of silver nanostructures allows optimization of plasmon resonance properties for improved molecular detection and spectroscopy and in plasmonic waveguiding. [C225]

"A novel photovoltaic nanodevice based on the co-integration of silicon micro and nanowires

prepared by electroless etching with conformal plasma doping"

Periodically patterned co-integration of silicon microwires (MWs) and nanowires (NWs) were applied for a novel photo-voltaic (PV) nanodevice. The optical improvement due to antireflection enhancement with a graded-refractive-index (GRI) effect (see Fig. 1) was observed by employing the tapered NWs. Si MWs that formed a radial p-n junction were located in between the dense array of Si NWs. These wire arrays were cost-effectively defined by metal-assisted electro-less wet etching. The co-integrated nanostructure of Si NWs and MWs demonstrated a high short circuit current (Jsc) and cell conversion efficiency (CE) compared to a sole array of Si NWs or MWs. Highest values of Jscand CE at 1.5AM illumination were recorded as 24.89 mA/cm2and 8.45%, respectively, which have been champion data reported to date in wire based PV cells using a radial p-n junction. [C226]

"HONET09 CD label"

The following topics are dealt with: bandwidth allocation, bandwidth on demand, all optical wavelength routed WDM networks, iterative path decomposition algorithm, hybridized parallel techniques, Internet backbone networks, light-wave communication wavelengths, secured passive optical networks, all optical interferometric detection, predictive prefetching, integrated reconfigurable optical add-drop multiplexer, telemedic sensor networks, wave-mixing optical cross connects, optical packet switch, plasmonic nanostructure gratings, adaptive fractional frequency reuse, adiabatic coherent quantum tunneling, magnetic lattices, IDMA systems, digital PPM receiver, acousto-optic deflector, high-speed laser diodes, electro-optic modulators, radio-over-fiber, optical buffers, wireless sensor networks, nanoplasmonic splitter, Mach-Zender interferometers, fiber Bragg grating, electro-absorptive quantum well, WDM network traffic grooming, optical CDMA correlation, chip level receivers, array waveguide grating, TCP protocols, OBS networks, optical chaotic communications, chaotic semiconductor laser, dynamic bi-directional multicast shared tree, and silicon microring vertical coupler. [C227]

"Light absorption enhancement in metal-semiconductor-metal photodetectors using plasmonic nanostructure gratings"

In this paper, we adopt the finite difference time-domain (FDTD) method to optimize the absorption of a novel metal-semiconductor-metal photodetector (MSM-PD) structure based on the use of a double-layer nanostructured metal grating. The metal fingers of the MSM-PDs are etched with appropriate depths to maximize light absorption through plasmonic effects. Simulation results show 40 times enhancement in 980 nm light trapping due to extraordinary optical signal propagation through the nanostructured double-metal grating, in comparison to conventional MSM-PDs. [C228]

"Surface nanostructure optimization for solar energy harvesting in Si thin film based solar cells"

The solar energy harvesting of Si thin films with Si nanocone or nanopillar array decorated surfaces is systematically studied by simulation for the first time. It is found that the high and broad-width light absorption around 2.5 eV is the key to achieve high efficiencies for both structures. Nanostructure dimensions are optimized based on the enhanced light scattering, and thus the prolongated optical path around this energy. This work provides a practical guideline to design and fabricate Si thin film solar cells with high efficiency matching the bulk Si record. [C229]

"The growth of zinc oxide nanocrystals on the zinc oxide thin film by chemical bath deposition"

In the paper the low temperature deposition of zinc oxide called Chemical Bath Deposition (CBD) will be described. Zinc oxide nanocrystals grow on the thin layer of ZnO. In our investigation the thin film of ZnO was deposited using spin coating, on the glass substrate covered with thin film of Indium Tin Oxide (ITO). The goal of our research is to develop a cheap method of ZnO nanostructures growth, which will be applied in electrochemical gas sensors as a gas sensitive layer. [C230]

"Synthesis of zinc oxide nanorods in ionic liquid via ultrasonic irradiation"

Zinc oxide is a versatile material that has achievable applications in piezoelectric transducers, nanogenerators, transparent electrodes and etc. Currently, sonochemical processes have been proved to be a useful technique for generating various nanostructured materials. In this work, we have developed a method for the synthesis of ZnO nanostructures, by combining the advantages of both ionic liquid and ultrasound. A simple approach for the preparation of ZnO nanorods via ultrasonic irradiation in 1-butyl-3-methylimidazolium tetrafluoroborate (BmimBF4) is reported. The morphology and properties of ZnO nanorods have been characterized using X-ray diffraction (XRD), transmission electron microscopy (TEM) and photoacoustic (PA) spectroscopy. A possible mechanism is proposed to explain the formation of ZnO nanostructures. [C231]

"Smart nanostructure derived by low energy cluster beam deposition"

Smart nanostructures such as magnetostrictive and magnetoelectric films have drawn a continually interest due to their potential applications in the micro-electro-mechanical system devices. We have developed an effective preparation method, namely low energy cluster beam deposition to prepare the cluster-assembled Tb-Fe nanofilms. A well-defined Tb-Fe nanostructured film has been obtained, which exhibits excellent magnetostriction, much higher than the common Tb-Fe films. Then the Tb-Fe nanocluster beam was deposited onto the surface of the PZT film through the open holes of the mask. Thus, the Tb-Fe/PZT magnetoelectric composite film has been prepared successfully. One observes that the interface between Tb-Fe and PZT layers is clear and no transition layer is observed. The composite film exhibits good ferromagnetic properties, and the strong magnetoelectric effect was observed in the composite film. [C232]

"Growth mechanism for vertical growth of nanopillars in progressive annealed HWCVD grown silicon nanostructures"

Here we propose a growth mechanism for the vertically growing conical nanopillars in progressive annealed samples grown using Hot Wire CVD process. Paramagnetic defects are present in a-Si:H films grown at low temperatures (Ts<300Г‚В°C). During progressive annealing, at around 500Г‚В°C, dehydrogenation of a-Si takes place; but at higher temperatures rehydrogenation alongwith crystallization of a-Si facilitates the vertical growth of nanopillars. [C233]

"Point defects in relaxed and strained Si studied by molecular dynamics method"

Molecular dynamics simulations using the Tersoff potential have been performed to investigate the perturbation effects caused by different kinds of the point defects (vacancies and substitutional impurities) on the strained and relaxed Si matrices. Lattice distortion, mean square displacement, pair correlation function and vibrational spectra are studied. It is found that Ge substitution lead to little distortion of the Si matrix. However, vacancy and C substitution lead to more distortion. Diffusion directions of Si atoms around different kinds of point defects are different. When C substitution is introduced in the relaxed Si matrices or Ge substitution is introduced in the strained Si matrices, the system needs longer time to reach equilibrium. The crystallinity and symmetry degree of relaxed Si matrices are more satisfying than those of strained Si matrices after relaxation. Changes of the vibrational spectra caused by vacancy and C substitution are obvious. All above have a great effect on the photoelectric properties of the materials. [C234]

"Direct detection of long, periodic, ssDNA nanostructures assembled on CMOS transistor arrays"

DNA is a wonderful material for the construction of nanostructures for a variety of applications. This paper describes a novel platform integrating single-stranded DNA (ssDNA) nanotemplates with CMOS-compatible, field-effect sensors. The field-effect sensor was based on oxide-semiconductor field-effect transistors (OSFETs), which were monolithically-integrated with signal-processing circuits to enhance the signal-to-noise ratio, and to detect the construction of ssDNA nanotemplate from complex DNA-protein interactions. The ssDNA nanotemplate on the transistor arrays was prepared by isothermal rolling circle amplification (RCA) through DNA aptamer-protein recognition and self-assembly strategy. The growth of the DNA nanostructure was monitored in situ, real-time and label-free on OSFET. [C235]

"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 Г‚ВїAnd-Or-InverterГ‚Вї (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. [C236]

"Scanning and measurement of carbon nanofiber nanoelectrode arrays using Atomic Force Microscopy"

One of the major limitations in the development of ultrasensitive electrochemical biosensors based on one-

dimensional nanostructure is the difficulty involved with reliably fabricating nanoelectrode arrays (NEAs). In previous work, a simple, robust and scalable wafer-scale fabrication method to produce multiplexed biosensors is introduced. Each sensor chip consists of nine individually addressable arrays that uses electron beam patterned vertically aligned carbon nanofibers (VACNFs) as the sensing element. To ensure nanoelectrode behavior with higher sensitivity, VACNFs were precisely grown on 100 nm Ni dots with 1 Г‚Вїm spacing on each micro pad. However, in order to examine the quality and measure the height and diameter of the VACNFs, some surface detection and measurement tool at the nanoscale level is needed. In this paper, we introduce an approach to measure these nano-scale features through atomic force microscope (AFM). With this method, both the 2D and 3D images of sample surface are generated and the sizes of carbon nanofibers and cavities are obtained. Furthermore, statistical analysis is carried out to enable improvement of VACNFs growth and fabrication. [C237]

"Performance of CdSe tetrapods-gold as nanostructure electrochemical materials in photovoltaic cells"

Nanoscale rectennae (rectifying antennae) have been fabricated by combining rectifying organic self-assembled monolayers (SAM) with plasmonic materials because of their surface plasmon resonance (SPR) properties of capturing light. Gold antenna arrays are assembled by coating on CdSe tetrapod templates; the rectifying barrier is formed by self-assembled monolayer (SAM) of gold and electrolyte which contains alkylthiolate. Photocurrent measurements showed that electric currents can be induced at different wavelengths within visible range that strongly depend on the aspect ratio of the tetrapod. Adding gold layer can increase the generated photocurrents due to the rectification. Multiple mechanisms among the semiconductors, metals and electrolytes in response of photocurrent are indicated and analyzed. [C238]

"Absorption-related efficiency limits of quantum-confined p-i-n intermediate band solar cells"

Integration of realistic absorption property calculations with conventional detailed energy balance model for an intermediate band solar cell (IBSC) is undertaken for a more pragmatic evaluation of quantum confined p-i-n solar cells. The model takes into account realistic design parameters such as actual device thickness, nanostructure dimensions and distributions, and strain induced deformations. The results presented here elucidate the physical origin of rather disappointing experimental data on the much sought after quantum dot solar cells, which, at least as they are currently designed, seem to be thermodynamically condemned to not exceed the efficiency of their conventional single junction counterpart. The presentation also provides a clear set of minimal design rules and examples that may allow quantum-confined IBSC to significantly exceed the Shockley-Queisser efficiency limit. [C239]

"High system performances with plasmonic waveguides and functional devices"

The operating principle of plasmonic waveguides and their functional devices is reviewed within the 2 to 5 mum mid-infrared spectral region for higher system performances in data communications, signal processing and sensors industries. [C240]

"The electron field emission from the Si nanostructures formed by laser irradiation"

Silicon electron field emitters may be attractive for numerous applications, mostly due to their compatibility with the dominating Si-based solid state microand nanoelectronics. The technology of nanostructure formation through a laser radiation (LR) on Si surface for the electron field emitter is proposed. N-type Si wafers are used in the experiments. The experiments were performed in an ambient atmosphere at 1 atm. pressure, at a room temperature T=20degC with a humidity of 80%. Radiation from a pulsed Nd:YAG laser second harmonica (pulse duration 10 ns; wavelength 532 nm; power 1MW) was normally directed at the Si surface. The spot of a laser beam of 3 mm in diameter was scanned over the sample surface. In the experiment Electronic scanning microscope, Atomic force microscope and Electronic field emission facility were used. In this particular experiment nanometer size cone-like nanostructures were created on the surface as a result of laser irradiation. Cone-like structures with nanosphere on top of the cone formed after the irradiation by the laser. A decrease in the nanosphere diameter from 600 nm to20 nn with an increase of intensity of LP from 2.0MW/cm2to 20.0 MW/cm2was observed. [C241]

"Moirй method for nanoprecision wafer-to-wafer alignment: Theory, simulation and application"

The two dimensional (2D) moireacute centrosymmetric grating is developed to assist realization of high-precision wafer-to-wafer alignment and non-destructive measurement of misalignments for wafer bonding. Using these moireacute patterns the misalignments in the order of plusmn 64 nm in X-Y axis can be resolved by a simple IR microscopy (5times objective) images. This value can be further improved to sub-10 nm range if the sub-pixel estimation is performed. For current status, the limit of the minimum resolved misalignment using moireacute

gratings is ~0.2 nm according to theoretical analysis. It can be applied for not only the future 3D integration of wafer-scale, but also the fabrication of 3D nanostructures and advanced lithography techniques. [C242]

"Fabrication and hydrogen sensing properties of Titania nanotubes"

TiO2nanotubes have wide applications in gas sensing applications such as oxygen sensors and hydrogen sensors. In this work, crystallized TiO2nanotubes self-assembled on Ti substrate were fabricated through anodization and heat-treatment. The anodization parameters for fabricating optimized nanostructures were investigated and hydrogen sensing properties of the nanotubes were tested. It was found that the anodization temperature and voltage had a great impact on the formation of uniform nanotubes or nanostructures. And the nanotubes assembled on Cu-coated PCB demonstrated a good hydrogen sensing properties at room temperature. [C243]

"Synthesis and field emission properties of large-area arrays of tungsten oxide pencil-like nanostructure"

In this study, large-area W18O49pencil-like nanostructure arrays can be grown on silicon substrate by multi-step thermal evaporation process is demonstrated. A side view scanning electron micrograph of a typical W18O49pencil-like nanostructure arrays (a) and the enlarged SEM image (b) of a nanotip, as well as their typical SAEDS spectrum (c) and typical XRD spectrum (d) is shown. The samples of W18O49pencil-like nanostructure arrays exhibit very good field emission characteristics. The array of low density has a better field emission characteristic and this indicates that lowering the density may decrease the field screening effect. [C244]

"Super wetting of micro &nano structured titania surfaces"

Surfaces with tunable wettability are of great importance for both fundamental research and practical applications such as heat pipes. In this work, micro-& nano-textured (bitextured) titania structures (BTS) based on titanium micromachining and surface oxidization techniques are proposed to function as wicking material requiring super wetting by common fluids such as water. We show theoretical studies and experimental work to investigate the wetting behavior of two different designs of BTS. For heat pipe applications the BTS not only increases the capillary pressure which enhances liquid pumping, but also increases the heat transfer performance by extended surface and smaller pore sizes. [C245]

"Nanometer-order base length, sharp and uniform field emitter arrays fabricated by transfer mold method"

In this paper nanometer-order base length, sharp and uniform field emitter arrays with 64 nm base length and 2.5 nm tip radius, which is the smallest and sharpest FEAs ever reported, have been developed by transfer mold method to realize the uniform and stable field emission characteristics. The reverse-pyramidal shape mold with thin SiO2layer for sharpness was fabricated by using e-beam lithography. It was formed on Si substrates by anisotropic etching, on which emitter materials Ni thin-film are deposited using ultrafine electroplating method. The emitter film was bonded to another substrate, and then the Si-mold substrate was removed entirely. Resultantly, the sharpened emitter array could be obtained reproducibly and uniformly.Thus nanostructure Ni-FEAs have been developed using by transfer mold method with high uniformity and reliability. The nanostructure transfer mold FEAs with 64-nm-base length can be useful for field emission device and vacuum nanodevice. [C246]

"Field induced hot-electron emission from quasi one-dimensional nanostructures of wide band gap semiconductors"

In recent years, many experimental studies are reported on field electron emission from semiconductor nanostructures, but the related theoretical study is lacking behind. Thus, a number of important experimental observations are not physically explained; these include nonlinear plots on FN coordinates and extremely large field enhancement factors (beta FN) determined by fitting based FN theory. In this work, the above two phenomena are explained theoretically by adapting the field induced hot electron emission model. R. V. Latham, et al. [1995] proposed the hot electron emission model, and later K. H. Bayliss et al. [1986] developed it to explain the observed field electron energy spectra. N. S. Xu et al. [1986] further developed the model by introducing the expression of "effective temperature" into the field emission I-V characteristic, and to explain the emission pattern from a metal-insulator-metal microstructure. All the above results has been called Latham-Bayliss-Xu (LBX) model [2001]. We consider the penetration of electric field into a quasi one-dimensional nanostructure of wide band gap semiconductor and its 'heating effect' to electrons. Because of 'heating effect' of

penetration field, the average energy of electrons can be higher than that of no external field. This higher energy can be expressed by effective temperature Teof electrons, which is much higher than the temperature of bulk of the emitter. Using the effective temperature in thermal emission j-E expression and Murphy and Good j-E expression in low field and relatively high field cases, the relation between emission current density (j) and external field (E) is described and the field enhancement factor (betatau) is calculated quantitatively. [C247]

"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. [C248]

"Arrayed microring filter with tunable resonance wavelength, extinction ratio and bandwidth"

We demonstrate a tunable filter based on an array of silicon-on-insulator microring resonators. The resonance wavelength, extinction ratio and bandwidth can be simultaneously controlled by thermal tuning. [C249]

"Redirection of lateral emission using nanorod reflectors for power enhancement of GaN light emitting diodes"

We fabricate the nanorod arrays at the periphery of light-emitting mesa as the reflector. The nanorod arrays redirect the laterally propagated light. The output power is enhanced by 32.1% at 30 mA injection current. [C250]

"Plasmonic EIT at the Drude damping limit"

We experimentally demonstrate a nanoplasmonic analog of electromagnetically induced transparency utilizing a stacked optical metamaterial. Specifically, we achieve a very narrow transparency window with high modulation depth due to nearly complete suppression of radiative losses. [C251]

"Fabrication of antireflection nanostructures on GaAs by holographic lithography for device applications"

We demonstrate the fabrication of antireflection nanostructures on GaAs using holographic lithography. Measured results of the fabricated nanostructures are in good agreement with the calculated values using a RCWA model, effectively suppressing the surface reflection over visible and near-infrared ranges. [C252]

"A multi-layer film model for formation mechanism of bright whiteness in beetle scale"

By taking the optical imaging of the internal micro-nanostructure of white beetle scales, a multilayer aperiodic model is presented in this paper to understand the complex natural formation mechanism of bright whiteness of a kind of white color beetle. Based on the proposed model, optical simulations of visible light reflectivity are conducted correlated with the variation of layer number, layer thickness and incident angle of visible light with alteration of the air-layer and chitin layer. The results showed larger incident angle will lead to lower reflectivity, smaller number of layers will also lead to lower reflectivity and higher fluctuations within the range of visible bandwidth. The simulated results match well with the measured reflective data, and the proposed model is reliable to interpret the formation mechanism of bright whiteness in beetle scale. The work here is an effect to further fabricate novel high-brightness optical composite Alms or coating materials for a variety of applications. [C253]

"SUrface modification for adhesion enhancement of PET/silicone using atmospheric plasma-induced grafting"

Summary form only given: In the study, an atmospheric-pressure plasma-induced grafting (APPG) has been developed to induce surface modification change on adhesion of polyethylene terephthalate (PET) surface and silicone. The Argon plasma was generated by a RF power under atmospheric-pressure. The most significant feature (APPG) of the process developed in this study was to induce chemical grafting using organosilane vapor

(with argon as the precursor carrier gas) simultaneously with the plasma treatment of the surface undergone modification. It was observed from the AFM results that the surface morphology of PET surface, the APPG processing created substantial amount of nanostructure grains with well organized features. Moreover, the measured water contact angles and XPS results showed that the O / Si and C / Si ratios of the PET surface were found to be substantially decreased by APPG processing. However, the PET surface and silicone showed organic and inorganic composition, respectively. It is to be noted that the Si-C and Si-O bond (inorganic) were grafted on the PET surface by APPG processing using organosilane vapor, and the surface contained CH3functional group structure (organic). It was observed from adhesion strength results that the adhesion strengths are much higher in APPG processing using organosilane than that are in APPG processing. The strong adhesion of APPG-treated PET surface s attributed to the strong interaction between the SiCO/CH3functional group of crosslinked on the PET surface and silicone. [C254]

"Nanometer-scale machining by laser ablation with a focused extreme ultraviolet laser beam"

We report the ablation of 200 nm-top wide (130 nm FWHM) trenches on PMMA photoresist by focusing the extreme ultraviolet output from a table-top capillary discharge laser with a Fresnel zone plate lens. [C255]

"Direct pick, break, and placement of nanostructures and their integration with MEMS"

A direct, simple, and versatile assembly method for the manipulation of one-dimensional nanostructures and their integration with MEMS has been demonstrated. Using common MEMS equipment-an optical microscope and an unbiased tungsten probe-the facile process has been employed to accurately manipulate titanium dioxide nanoswords and zinc oxide nanowires under a room-temperature, dry environment. The surface morphology of the nanostructures, probe tips, and adhesion forces were characterized. Using this process, a nanosword was integrated with a MEMS device to characterize its sensitivity to ultraviolet light. As such, the technique could enable the rapid assembly of individual nanostructures with CMOS-compatible devices. [C256]

"Graphene as thin film infrared optoelectronic sensor"

We present the conductometric behavior of a single atomic carbon nanostructure (graphene) that could be promising to infrared optoelectronic applications. A graphene nanomanipulation system with focused infrared laser source for optoelectronic property characterizations is implemented. The feasibility of mechanical and electrical probing manipulations on two-dimensional thin film nanostructures is studied. Using this system, we revealed the infrared optoelectronic properties of mono- and multilayer graphene. The obtained optoelectronic parameters are compared to the single- and multi-walled nanotubes. A graphene infrared sensor is prototyped by direct writing of electrodes using gold nanoink fountain-pen method and is analyzed by electrical probing. Results show that graphene could be a promising building block for thin film optoelectronic devices. [C257]

"Preparation of CuO Nanorods in Ionic Liquids"

CuO nanorods were prepared by microwave-assisted method in the ionic liquid 1-butyl-3-methylimidazole tetrafluoroborate which is synthesized by method of substitution halogenated hydrocarbons for organic macromolecular (methylimidazole) in this experiment. The samples were characterized by means of IR spectroscopy, X-ray powder diffraction (XRD), scan electron microscopy (SEM) and transmission electron microscopy (TEM). The above mentioned results showed that the length of the CuO nanorods was 1000 nm, the diameter was 50 nm, and morphology was the hemisphere in both sides. Meanwhile the growth mechanism of CuO nanostructures was also studied. [C258]

"The effect of temperature on the recombination rate of AlGaN/GaN light emitting diodes"

Nitride semiconductors and their alloys recently have versatile applications as high-power and high-efficiency electro optical devices duo to their high thermal stability, direct transition and wide bang-gap. Nanostructure light emitting diodes of these materials have an emission spectrum from infrared to ultraviolet. In this paper, besides simulating a nanostructure nitride semiconductor LED, such as multi quantum well nitride LEDs, the effect of temperature on the recombination rate has been investigated. [C259]

"Nanolab fabrication for nanoelectronics and sensors"

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 study and realise new structures for nanoelectronic devices and for sensor applications. The idea is to start from a basic nanostructure for electronic devices, nanogaps, to generalize its concept for implementation of a general system for the realization of nanodevices, giving to researchers the opportunity to work on their specific

application and having an already prepared working base, ready to be customized for the specific design needs. The idea is to develop this new concept starting from the real application of nanogaps in which authors have a matured experience. [C260]

"Electrochemical processes and characterisation of doped Tio2 thin films; Relationship between preparation conditions and nanostructure"

In this paper, we report an experimental study on electrochemical anodization using different acidic electrolytes of high purity Ti thin film deposited on silicon substrate by sputtering. The dependence of pore morphology and pore formation rate on process parameters was evaluated. In order to investigate the crystallization, after anodization, samples were annealed in a quartz tube furnace at different temperatures using nitrogen gas for annealing. The influence of electrolyte composition and annealing temperature on the nanostructure and morphology of the oxide layer and the changes induced by the heat treatment, were also investigated by SEM, FTIR and Raman spectroscopy. TiO2film was doped with phosphorus and palladium to improve electrical conduction. [C261]

"SNOM measurements on metalic nanostructures"

We present transmission and reflection near field scanning optical microscopy (SNOM) images on a metallic nanostructure realized by a combination of electron beam lithography (EBL) patterning and liftoff procedure. The structure consists in a square lattice of gold disks of 80 nm height with the diameter of 200 nm and the lattice constant of 400 nm. FDTD simulations were used in order to understand the interaction of the optical near field with the nanostructure and to interpret the SNOM reflection images. [C262]

"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. [C263]

"Photo-catalytic chemical reactor with plasmonic nanostructure"

3D-FDTD is used to compute the electromagnetic response of various plasmonic nanostructures. And, novel techniques to fabricate large area of plasmonic nanostructures for photo-catalytic reactors are reported. Experimental results also demonstrate an improved photo-catalytic efficiency. [C264]

"Exotic emissions of erbium and ytterbium doped silica-zirconia nanostructured optical fibers"

Original emissions in nanostructured silica-zirconia based optical fibers doped with erbium and ytterbium ions are presented. The influence of the nanostructure on the luminescence properties is highlighted and the different mechanisms are explained. [C265]

"High harmonic generation by plasmonic enhancement of femtosecond laser pulses"

Plasmonic enhancement of femtosecond laser pulses using a bow-tie metallic nanostructure enables the high harmonic generation of EUV radiation for high-resolution lithography, imaging, and spectroscopy. [C266]

"Spatio-temporal control of local plasmon on noble metal nano-structures by ultra-broad femtosecond laser excitation"

We propose a new scheme to control spatio-temporal distribution of local plasmon generated on noble metal nano-structures by arbitrarily frequency chirped or polarization shaped ultra-broad femtosecond laser pulses. [C267]

"Polarized stimulated emission of ZnO microbox"

The polarized emission from nano-structured micro boxes of ZnO has been measured with ultrafast time-resolved laser spectroscopy and the relationship between photoluminescent (PL) mechanisms and corresponding degrees of polarization has been discussed. [C268]

"Ultrasonic Nanostructured Thin Film Transducers for Flooded Member Detection"

In this paper, we report a simple and accurate method to detect water in hollow pipes using a nanostructured thin film (NSTF). The NSTF was used as a piezoelectric transducer to mitigate health concerns generated by the current common flooded member detection technique, gamma radiography, and alleviate problems associated with using complex ceramic piezoelectric transducer arrays in flooded member detection. During testing of the NSTF's detection capabilities, discoveries were made which show the NSTF is a more viable candidate for flooded member detection than commercially available ultrasonic transducers due to the unique characteristics of the detected waveforms. Using the NSTF transducer for flooded member detection confers the accuracy and straightforward interpretation of results of radiological detection while avoiding detrimental exposure to the operator without the need of an ultrasonic multi-transducer detection system. [C269]

"Synthesis, optical properties and functional applications of ZnO nano-materials: A review"

This review article summarizes briefly some important achievements of our recent research on the synthesis, optical properties and novel applications of nano-structured ZnO such as nanorods and honeycomb shaped 3-D (dimension) nano random-walls. A chemical reaction/vapor transportation deposition technique was employed to fabricate those structures on ZnO/SiO2/Si substrate without any catalyst and additive in a simple tube furnace to aim the low-cost and high qualified samples. Random laser action with strong coherent feedback at the wavelength between 375 nm-395 nm has been firstly observed under 355 nm optical excitation with threshold pumping intensity 0.38 MW/cm2in ZnO 3-D random-wall nanostructure. [C270]

"Enhanced photoluminescence excitation in surface plasmon coupling with an InGaN/GaN quantum well"

We observe the enhancement of photoluminescence excitation through the coupling of an InGaN/GaN quantum well (QW) with surface plasmons which are generated on an Ag nanostructure deposited on the SiN-coated QW epitaxial sample. [C271]

"Preparing graphitic nanoribbons from ultrathin electrospun poly(methyl methacrylate) nanofibers by electron beam irradiation"

Using ultrathin electrospun poly(methyl methacrylate) (PMMA) nanofibers as precursor, graphitic nanoribbons could be prepared by electron beam irradiation. With the help of the high resolution transmission electron microscopy, the real time processing of the carbonization and graphitization of the PMMA nanofibers could be clearly seen. By precisely controlling the irradiation, the graphitic nanoribbons could be fine-tuned. The mechanism of the transformation from PMMA to graphitic nanoribbons was analyzed detailedly. This new way to obtain graphitic nanoribbons from ultrathin electrospun PMMA nanofibers has promising potential applications in graphitic carbon nanostructure electronics and devices. Meanwhile, this carbonization and graphitization explained how PMMA could be inverted into negative electron resist from positive resist by high dose electron beam lithography, which provides a way to obtain patterned graphitic nanostructures directly from PMMA. [C272]

"Coherent exciton-surface plasmon polariton interactions in hybrid metal semiconductor nanostructures"

We report on the coherent coupling between surface plasmon polaritons and quantum well excitons in a hybrid metal-semiconductor nanostructure. The coupling is probed by angle-resolved low temperature spectroscopy and analyzed within a coupled oscillator model. [C273]

"Random laser emission from ZnO nanocomposite hybrids"

Highly scattering ZnO-hybrid nanostructures are produced exhibiting random laser action upon optical excitation. Studies that investigate the influence of pump pulse duration on the random laser efficiency are presented along with coherence length measurements. [C274]

"Nanofabrication of sub-wavelength grating using ultra-fine nano-machining process"

We present the nanofabrication of sub-wavelength grating using ultra-fine nano-machining process. We successfully demonstrate the nano-machining fabrication of 20 nm grating pitch for nano-structured photonic devices, which is also used for thermal nano-imprint mold. [C275]

"Sub-10nm nanolithography and direct pattern transfer on III-V compound semiconductor using sol-gel derived ZrO2"

A new approach for direct sub-10 nm pattern transfer using spin-coated ZrO2is presented. The sample InP compound etching selectivity to ZrO2is over 13:1 with highest aspect ratio of 35:1. The smallest feature is 9 nm. [C276]

"Modulating linear and nonlinear nanoplasmonic effects using the metal-insulator transition in vanadium dioxide"

Linear and nonlinear nanoplasmonic effects-such as resonant absorption, second-harmonic generation and extraordinary optical transmission- are modulated in metallic nanostructures when the local dielectric environment is altered by the ultrafast metal-insulator transition in vanadium dioxide. [C277]

"Three-dimensional metamaterials at optical frequencies"

We experimentally demonstrate the implementation of three-dimensional optical metamaterials. We investigate the interaction between adjacent stacked layers using the method of plasmon hybridization and analyze the optical properties of stacked metamaterials with increasing layer numbers. [C278]

"Harnessing attosecond science for visualizing the nanoworld"

New science and technology is enabled by manipulating and controlling electrons on attosecond timescales. Applications range from new table-top sources of coherent x-rays, to high-resolution tabletop coherent imaging of molecules, nanostructures, and materials. [C279]

"Local structural properties and growth mechanism of ZnO nanostrcutures"

We investigated the growth mechanism of ZnO nanorods using in-situ extended X-ray absorption fine structure (EXAFS). ZnO nanorods were synthesized with a solution method and the structural properties around zinc atoms were measured by the in-situ EXAFS at every process. The synthesis was started with the solution of ZnNO3powder and H2O. The solution was added with an amino acid complex and then heated up to 80degC. The EXAFS revealed that the zinc atoms of the solution had only two oxygen atoms without any second neighboring atoms, implying that ZnNO3is amorphous. When the complex was applied to the solution, the second neighboring Zn atoms appeared, although there was a substantial amount of structural disorders existing in the Zn-Zn pairs. This result suggests that the nitrogen ions in the complex play a role in clustering ZnO. At 80degC, ZnO was rapidly crystallized and the structural disorders disappeared. The in-situ EXAFS measurements provided the critical information of ZnO crystallization in the solution. [C280]

"Developments of fabricating nanostructure coatings by cold gas dynamic spraying"

Cold gas dynamic spraying (CGDS) is one kind of novel surface engineering technologies, depositing diversified metal, alloy and composite coatings by high-speed gas current under room temperature or with a little heated. Due to its peculiar characteristics such as low spraying temperature, nonoxidation, low stress among coating layers, compactification, as well as high utilization rate, especially the technical advantages on fabricating nanostructure coatings, the CGDS process has attracted great attention. The paper reviews the current situation of researches on the CGDS technology, and summaries its development in fabricating pure metal, alloy as well as composite nanostructure coatings, mainly including their microstructures, properties, characteristics and applications. [C281]

"Directly assembly and electrical transport measurement of nanowires by nano-manipulator probes"

One of the important features to the success of 1D nanotechnology is the ability to manipulate nanostructures physically. Nanostructure assembly is challenging because the pertinent length scales prohibit direct locating and tinkering. So far, fluidic assembly schemes offer sufficient control to fabricate simple networks and dictate the macroscopic patterning of 1D nanostructures but not with the precision, pattern density, or complexity needed for

many applications. The alignment of 1D nanostructures via electric or magnetic forces suffers the additional frustration of fringing fields that make the construction of dense or complex architectures impractical. In this work, the directly assembling of the 1D nanowire by using the manipulator machine has been developed to provide a much controllable and accurate strategy in nanowire device fabrication and functional characterization of nanowires structure. The key advantage of this technique is the ability to precisely move the nano-materials by physically handling it which resulting in no chemical contamination. Through the micrometer-scale probe controlled by the manipulator poisoner, the individual building block such as ZnO, Si nanowires were able to be assembled into the patterned substrate. The electric static force and the electron beam deposition technique under SEM were used to anchor the nanowire to the substrate. After the individual nanowire has been localized to the target position, the in-situ IV measurement by the nanomanipulator was able to be carried out. [C282]

"Thiol based chemical treatment as adhesion promoter for Cu-epoxy interface"

The paper focuses on the use of thiol as adhesion promoter in Cu-epoxy interface. A parametric study on the thiol deposition procedure for Cu-epoxy system was conducted. Thiol concentration and deposition time was found to be important parameter in adhesion. Low concentrated solution leads to insufficient morphological modification while prolong treatment time results in fracture happened along weak boundary layer. The optimum condition for surface treatment with the current thiol was 5 mM solution for 10 hours. With this thiol treatment, adhesion which was given as fracture toughness has increased from 4.8 Jm-2for the untreated sample to 159 Jm-2. The 30 times adhesion improvement was related to presence of nanostructure upon thiol modification. Both the chemical bonding and morphological changes was found contributes to adhesion. [C283]

"Spontaneous current and voltage generation in gated quantum dot structures"

Theoretical results are presented on the electronic transport in the open zero-dimensional nanostructure, or a nanotransistor, in which we demonstrate the manifestation of the effect of the upconversion of the electronic energy level occupation. The self-consistent Born approximation is used to the electron-phonon interaction in a quantum dot. The well-known simple Toy Model of Supprio Datta is used for the description of a nanotransistor. We show that in an asymmetric nanodevice one can obtain a spontaneous potential step generation between the electric contacts of such a device. This will be documented numerically on a nanotransistor model in which the active region of the nanotransistor is a quantum dot having two electronic bound states. The effect can be important for the information processing using nanostructures. [C284]

"Fault-injection algorithm for the error of the single-event upset and calculation for the error resistance by coated nanofilms"

In this work, the R_T_S model based on simultaneous equations (R, T and S) and Catastrophe Theory is performed to describe the behavior of fault injection and the influence of fault injection on a system. The system was selected as a chip in a microelectronic device of a satellite, which is often failed to work by an error of the single-event upset (SEU). A fault-injection algorithm (FI_S) based on the S attribute of the model R_T_S is designed to analyze the errors in the attacked system. Based on silsesquioxane derive from hydrolytic condensation of [(gamma-glycidoxy)propyl]trimethoxysilane (GPMS), [(-methacryloxy)propyl]trimethoxysilane (MPMS) and (vinyl)trimethoxysilane (VMS), three nanofilm (f-GS, f-MS and f-VS) was coated on chips to protect from the fault. The equation expressing the relationship between the energy and the displacement of a charged particle was deduced. The total displacement where the higher energy was reduced by the inhibition of the nanofilm, can be calculated. As the result of the calculation, the f-VS coating has the best resistance to the SEU error because of its denser nanostructure. [C285]

"Photoluminescence and raman spectroscopy of single diamond nanoparticle"

The paper reports the techniques that we have devised for immobilizing and allocating a single nanodiamond on the electron beam (e-beam) patterned smart substrate. The properly designed coordination markers on the semiconductor substrate and the high throughput of the confocal microscope provide us with a convenient tool to single out a nanodiamond with a size less than 100 nm and to study its optical properties on a single nanostructure basis. We have observed a broad PL emission centered at about 700 nm from a single nanodiamond which is due to the defects, vacancies in the nano-diamonds or the disordered carbon layer covered on the nanodiamond surface. We also observe red-shift in energy and asymmetrical broadening in linewidth of the sp3bonding Raman peak when the size of the single nanodiamond is decreased. [C286]

"Nanostructure control of carbon aerogels and the application in lithium ion cells"

Carbon aerogels are derived via a sol-gel process with resorcinol and formodehyde and subsequent pyrolysis of the precursor (RF) aerogels. Due to their high surface area, electrically conducting network and chemical

inertness, carbon aerogels can be considered ideal electrodes in rechargeable batteries. In this paper the optimization of the preparation and structure controlling of carbon aerogels are studied. The influence of preparation conditions on the structural properties of carbon aerogels are investigated by scanning electron microscopy, nitrogen adsorption and X-ray diffraction measurements. Carbon electrodes are prepared using carbon aerogels powders and binder, with the carbon aerogel electrode as the anode and with lithium metal foil as the cathode, cells are made. Electrochemical measurements of the lithium intercalation properties for carbon aerogels are performed under high-purity argon in a glove box. The model cells show that the capacity for the first cycle and the rechargeable capacity are all very high, but the ratio of the rechargeable capacity to the total capacity (first cycle) is about 0.3 to 0.4. [C287]

"Dynamic tuning of slow light transmission in manual nanostructure photonic crystal waveguide"

Dynamical and external tuning of the slow light transmission by thermo-optic effect in two-dimensional photonic crystal waveguide has been investigated. The changes of the temperature can modulate the cutoff or turn on of the guided mode in PBG. In additionally, the group velocity at identical wavelength of the guided mode can be tuned at the same time. It can be used to modulate the speed and turn on or off of the guided mode. [C288]

"Quantitative analysis of Si/Ge quantum structures by high-resolution transmission electron microscopy"

Quantitative high-resolution transmission electron microscopy was used to examine structural peculiarities of SiGe quantum islands on an atomic scale. A combination of high-resolution transmission electron microscopy and geometric phase analysis was applied to study the deformation fields of SiGe quantum islands grown on a Si(001) substrate by an ultrahigh vacuum chemical vapor deposition system. The numerical moire method was applied to visualize the lattice fringe surrounding the interface defects. [C289]

"Synthesis of nano-sized ZnO structure in ionic liquid"

ZnO nanorods were successfully synthesized by thermal decomposition of Zn (OH)2in the ionic liquid 1-butyl-3-ethylimidazolium tetrafluoroborate. Their structure and morphology were characterized by means of infrared spectroscopy (IR), X-ray powder diffraction (XRD), and transmission electron microscopy (TEM). The TEM results indicate that the diameter of the ZnO nanorods was 10 nm, and the length was 200 nm. The XRD pattern reveals that the ZnO nanorods belong to the hexagonal crystal system. The results show that ionic liquid can not only act as a reaction medium but also modify ZnO nanorods in the reaction. In this paper the growth mechanics of ZnO nano-structure was also preliminary studied. [C290]

"Modeling and measurement of optical response of 1D array of metallic nanowires for sensing and detection application"

We have investigated 1D nanosized metallic wires with subwavelength dimensions in which localized surface plasmon (LSP) and surface plasmon polariton (SPP) can exist. Elaboration of the localized surface plasmon resonance (LSPR) based device for scaling down to nanometric dimensions, which provide significant flexible design is the aim of this paper. Modeling of the interaction of the incident light with the periodic system of nanowires (differential formalism) and measurements of the optical (transmittance, extinction) properties of the structures under consideration were performed to reveal the general trends in the design of the gold nanostructure geometry to optimize sensitivity of sensor system. [C291]

"Silicon quantum dot devices"

Quantum dot structures, where electrons are confined three-dimensionally in the below 10 nm scale, show characteristics quite different from conventional bulk structures. Recent progress in the fabrication technology of silicon nanostructures has made possible observations of novel electrical and optical properties of silicon quantum dots, such as single electron tunneling, ballistic transport, visible photoluminescence and electron emission. Electron transport and photonic properties of silicon nanocrystals prepared by plasma processes are described with particular emphasis on fabrication of monodispersed silicon nanocrystals, high-density assembly of silicon quantum dots, silicon nanodot memory, NEMS devices, and silicon photonic devices. [C292]

"Commentary: Trends, Challenges and Opportunities in Semiconductor Memory Technology Scaling"

As IC dimensions continue to shrink into the nanometer realm, conventional CMOS scaling appears to be running up against thermal and physical scaling wall. Technology innovations that can circumvent these scaling

limits are required in order to achieve the performance gains needed to support the market demands. These performance requirements are driving the introduction of new materials and devices architectures in the process flow. In addition, the aspect ratio of nanostructures is increasing since the vertical dimension of the nano scale device structures in many instances, does not shrink. These high aspect ratio nanostructures pose a variety of new challenges related to patterning, deposition, and cleaning processes, and for the mechanical stability during and after fabrication. Nanotechnology is driving developments of materials with unique physical and chemical characteristics. These materials can potentially help extend the scaling of CMOS based semiconductor devices for logic and memory applications. For memory, conventional charge based concepts may be reaching fundamental limits and new concepts need to be explored. [C293]

"Completeness of smoothed particle hydrodynamics (SPH) method and its corrective methods in time-domain electromagnetics"

In this paper, a comparison completeness of the three kernel approximations that are commonly used in smoothed particle hydrodynamics (SPH) to polynomial functions and their derivatives is conducted. Those are applied for the time domain Maxwell's curl equations and the numerical results is compared with analytic solution. It is shown that the smoothed particle method for Maxwell's equations-smoothed particle electromagnetics (SPEM)-has a high potential in computational electromagnetics and nanostructure. [C294]

"The combination of proton-exchange technique and electron-beam lithography for integrated waveguides"

We proposed a new method to fabricate waveguides with low loss and reduced dimension. This method combines the conventional proton-exchange technique for long straight segments of waveguide made of Lithium Niobate and the Electron-beam (E-beam) lithography for splitting/bending points. Advantages of both techniques allow low loss of propagation in long distance, and a near-zero loss at sharp splitting/bending angle. They therefore allow reduced size of waveguides to several tens micrometers or smaller. Transmission of light with wavelength lambda0of 632.8 nm on proton exchanged waveguides was measured. The extraction ratio between two outputs was measured as 1.03. The simulation of the photonic crystal waveguide for the replacement of light splitting part was also carried out, and demonstrated the functionality for low loss light transmission. The combined method is appropriate for many applications like waveguides, modulators, divider, etc. [C295]

"Nanostructured polymer solar cells"

Polymer solar cells generally contain a low bandgap p-type conjugated polymer as photosensitizer and an inorganic or organic n-type semiconductor as electron acceptor. We investigated two nanostructured composites of the complementary semiconductors: nanometer-scale blends and interpenetrating nanorod arrays. In the blend approach, new low bandgap polymers were synthesized to match with electron-acceptors such as C60-PCBM and C70-PCBM for increased absorption efficiency. The nanorod arrays were fabricated by solution-based electrochemical growth. Photovoltaic performance of the composites is also discussed. [C296]

"Physical Characteristics of HfO2 Dielectrics at the Physical Scaling Limit"

Phase identification and the degree of crystallization in ultra-thin HfO2has been extremely challenging due to the > 5 nm range order sensitivity of X-ray diffraction which is not sufficient to detect nanocrystallization. Yet detailed knowledge of the nanostructure is critical to the development of accurate performance models. Therefore, atomic layer deposited (ALD) and annealed HfO2films have been studied by extended X-ray absorption fine-structure (EXAFS) and glancing angle X-ray diffraction (GIXRD). EXAFS is sensitive to local structural distortions on a length scale of a few Angstroms, making it a highly desirable probe for elucidating physical characteristics of ultra-scaled HfO2. Analysis of the Fourier Transformed (FT) data provides information on the near-neighbor coordination, distance, and local disorder around the Hf atom. We report an increase in the fraction of higher-k tetragonal HfO2with decreasing film thickness, which is consistent with a surface energy effect and the critical grain size phenomenon. [C297]

"Spin-dependent phenomena and their implementation in spintronic devices"

The general purpose of spinelectronis is to take advantage of the spin of electrons in addition to their charge to obtain new phenomena and conceive innovative electronic components. The first application of spinelectronics is in magnetoresistive heads for computer disk drives based on the giant magnetoresistance phenomenon. The discovery of tunnel magnetoresistance in magnetic tunnel junctions has allowed the emergence of a new kind of non-volatile memory called magnetic random access memory (MRAM). It potentially combines the advantages of all existing memories: non-volatility of FLASH, speed of SRAM, density of DRAM, hardness to ionizing radiations

and endurance. Many research groups are nowadays investigating the use of these magnetic components for other logic applications. Spintronic phenomenon is the spin transfer effect allows controlling the magnetization of a magnetic nanostructure directly with a spin-polarized current. It attracts a considerable interest since it provides a new write scheme in MRAM and allows conceiving frequency tunable RF components. [C298]

"Design and computational analysis of a linear nanotube servomotor using DNA actuation"

Developments in the field of nano-biodevices coupling nanostructures and biological components are of great interest in medical nanorobotics. As the fundamentals of bio/non-bio interaction processes are still poorly understood in the design of these devices, design tools and multiscale dynamics modeling approaches are necessary at the fabrication pre-project stage. This paper proposes a new concept of optimized carbon nanotube based servomotor design for drug delivery and biomolecular transport applications. The design of an encapsulated DNA-multi walled carbon nanotube (DNA@MWNT) actuator is prototyped using a molecular dynamics simulator. Then, a multiscale dynamics model from the mechanics point of view is proposed through an atomistic-continuum approach. Based on the analysis of the simulation results, a servo nanoactuator using ionic current feedback is simulated and analyzed for application as a drug delivery carrier. [C299]

"Growth mechanism and field emission properties of inject-like ZnO nanostructure"

We report the fabrication process of injector-like ZnO nanostructures and their excellent field emission properties. Injector-like Zinc oxide (ZnO) nanostructures were synthesized on a Si (001) substrate with ~5 nm thick gold film by direct thermal evaporation of Zinc power under a low temperature of 600 degC and normal pressure. Field emission scanning electron microscopy (FESEM), x-ray diffraction (XRD), Raman and photoluminescence (PL) were applied to study the structural characteristics and optical properties of the product. [C300]

"Dendritic palladium-silver nano-structure grown by electrochemical migration method for hydrogen sensing device"

We have developed a new method to fabricate Pd-Ag nanowire for hydrogen sensor application. Pd-Ag nanowire with 50~200 nm diameter is grown by electrochemical migration method in a few minutes. This is simpler, faster and lower-cost nanowire fabrication method than other processes such as templated nanowire growth. The response time of Pd-Ag nanowire is much shorter than pure Pd. The response time is about 5 seconds and the recovery time was equally short. [C301]

"Extreme ultraviolet interferometric lithography with a desk-top system"

We demonstrate an amplitude division interferometer that using illumination from a high brightness desk top extreme ultraviolet (EUV) laser creates large area arrays of lines, holes and dots with sub-100 nm feature size. [C302]

"Substrate study of tungsten nano-gratings deposited by a single femtosecond laser beam"

Sub-wavelength tungsten nano-gratings were grown using a single femtosecond laser beam on many substrates. Quantitative study of substrate reveals that substrates play a significant role in controlling the growth conditions and physical attributes of tungsten-nano-gratings. [C303]

"Fabrication of site-controlled, highly uniform, and dense InGaN quantum dots"

We report fabrication of site-controlled, highly uniform and dense (>=1e10/cm2) InGaN multiple stacks of quantum dots using selective area epitaxy in MOCVD. The dot height and lateral dimension are 3 nm and 30 nm, respectively. [C304]

"Eight-channel microring resonator array with accurately controlled channel spacing"

We demonstrate accurately spaced 8-channel micro-ring resonators on a silicon-on-insulator platform via thermal tuning. The thermal cross talk between adjacent micro heaters is small. [C305]

"Micro- and nanostructures inside sapphire by fs-laser irradiation and selective etching"

Micro- and nanofabrication of cavities in the volume of sapphire was performed by femtosecond laser irradiation followed by chemical etching with aqueous solution of HF acid. Depending on the focusing conditions self-organized nanostructures or elliptical microchannels are produced. This manufacturing technique is potentially usable for photonic crystals in integrated optical elements or microfluidic devices for applications in life science,

biology or chemistry. [C306]

"Laser precision engineering from microfabrication to nanoprocessing"

Laser precision engineering has unique advantages of non-contact process, flexible setup and high speed processing in air. In the last decades, we have witnessed its extensive applications in various production lines. Combined with other advanced processing tools, laser nanofabrication will play a much more important role in the next generation manufacturing. [C307]

"Templated self-assembly and nano-plasmonics of nano-void surfaces"

Three-dimensionally nano-structured metal surfaces containing nano-scale voids produce strong localised plasmons. We show here the correlation between physical structure and photonic and electronic properties for several significant applications. [C308]

"Nanophotodetector array for nano-imaging"

A novel near-field nano-imager based on nanophotodetector (NPD) array is presented. Simulation shows lambda/10 resolution could be obtained by NPD array. The initially realized NPD devices at 1.5 mum wavelength have the smallest pixel size of 50 nm. [C309]

"Improving quantum efficiency with nanostructured semipolar III-nitride light emitters"

We demonstrated nanostructured semipolar III-nitride light emitters on low cost c-plane GaN templates using one-step epitaxy. The total light emission efficiency is improved by a factor of 2.6 compared to polar emitters at room temperature. [C310]

"Fiber surface enhanced Raman scattering (SERS) sensors based on a double substrate "sandwich" structure"

A new configuration was designed and tested based on ldquosandwichingrdquo target analyte molecules between two metal nanostructure substrates using surface enhanced Raman scattering (SERS), which exhibits significantly higher SERS enhancement compared to just one substrate. [C311]

"Apex-enhanced second harmonic generation from asymmetric nanoscale arrays in a gold film"

The second harmonic generation from a non-centrosymmetric nanostructure in gold film is studied comprehensively. The sunglass aperture shape is chosen to have an apex to increase the local field. [C312]

"Characterization of Co-synthesized Titanium and ZnO nanostructures"

Pure and ZnO-Ti mixed nanowires were synthesized on a p-type silicon wafer. ZnO powder and Ti were mixed and mechanically milled in a ball milling machine. ZnO-Ti mixed nanowires were grown from the milled powder by using thermal evaporation method. Pure and ZnO-Ti mixed nanowires were grown by vapor solid method, using a furnace at 1000degC on a p-type silicon wafer. Characterizations have been done by FE-SEM, EDX and XRD. FE-SEM micrograph shows that the ZnO-Ti mixed nanowires are utilizing ZnO nanowires as bases to start the growth. Ti nanostructure cannot grow directly on the substrate. The segregative growth of Ti and ZnO nanowires describe the difficulty of incorporating Ti into ZnO nanowires. [C313]

"Quantum nanoelectronics: Challenges and opportunities"

After forty years of advances in integrated circuit technology, the scaling of Silicon Metal Oxide Semiconductor Field Effect Transistor (MOSFET) has entered the nanometer dimension with the introduction of 90 nm high volume manufacturing in 2004. Presently at 45 nm going to 32 nm node in 2009, the latest technological advancement has led to low power, high-density and high-speed generation of microprocessors. VLSI circuit and device simulation programs rely heavily on the laws of physics that are being discovered and re-discovered as devices are being scaled down to nanometer regime. The scaling of the Si MOSFET below 22 nm may soon meet its fundamental physical limitations. Nevertheless, novel devices and structures such as graphene, carbon nanotube field effect transistors (CNFETs) and nanowires offer a solution to overcome the performance limits. A clear understanding of a unique electronics and transport properties is vital as simulation programs always lag behind in implementing new findings and parameters that may or may not be physics-based. This paper examines quantum and nonohmic transport phenomena that are capable of predicting the performance of a nanostructure in device and circuit simulations. The ideas presented will allow researchers to identify the input

physical processes to form an intelligent perspective in interpreting the output obtained. [C314]

"Development of SAXS microtomography and related methods"

Small-angle x-ray scattering (SAXS) is a standard method for non-destructive structure analysis on the nanometer scale with synchrotron radiation. Many soft condensed matter materials (e.g. natural fibers, polymer fibers, wood, polymer parts) are nanostructured, and their macroscopic properties are a result of this structure. Frequently the nanostructure varies across the specimen under investigation. For these samples the combination of SAXS with microtomography opens up new possibilities for non-destructive studies of complex materials. The result is a mosaic of SAXS patterns, which are associated with defined volume elements in the specimen. These reconstructed patterns can be analyzed in order to track the variation of nanostructure inside the sample. Experimental details and results are illustrated in various examples. [C315]

"Nano-ZnO in Photonics Landscape"

Methodologies have been evolved to grow optical quality nanostructures of the 3.4 eV band-gap semiconductor ZnO and its doped variants with different orders of dimensionality. These nanostructures are versatile and yet under evolution for next generation UV-blue photonic and spin-photonic devices. There are pending lacunae such as reliable and enduring p-type carrier doping and large carrier mobility etc, which need further and deeper understanding of fundamental nature of ZnO as a semiconductor. [C316]

"Piezoelectricity of ZnO and its nanostructures"

The wurtzite ZnO material exhibits excellent piezoelectric property along the [0001]-direction because of the noncentrosymmetric structure. As a typical II-VI wide band gap compound, it has been long studied as a piezoelectric material. Here we review the previous theoretical and experimental researches on the piezoelectric properties of ZnO and its nanostructures. Some practical applications in nanodevices are also exhibited. The present review could serve as a good reference for future investigations in the relative fields, and also indicates potential applications in nanoscale devices. Our contributions on this review topic are focused on the theoretical investigations of piezoelectricity of ZnO nanostructures, including nanowires and nanofilms, by using first-principles calculations. For the nanowires, size-dependent axial piezoelectricity in [0001]-oriented ZnO nanowires with diameters ranging from 0.4 to 3.0 nm is investigated. It is shown that the effective piezoelectric constant e33of the nanowires increases with increasing diameter, and is approximately one order smaller than the bulk value due to the structural change on the boundary of the nanowires. The absolute value of the axial piezoelectricity induced by the radial strain e31is around half of the effective e33, which is similar to the bulk case. For the ZnO nanofilms, we find that the effective piezoelectric constant e33of ZnO nanofilms is also size dependent, and increases with increasing thickness in the nanoscale simulated in our work. When the film thickness is larger than 2.4 nm, the corresponding piezoelectric coefficient becomes higher than that of bulk ZnO. The enhancement over the bulk value reaches 11% when the film thickness is 2.9 nm. [C317]

"A nano-needle interface self-assembled by using cell migration for recording intracellular activity: Nano-needle durability"

This paper proposes a nano-needle intracellular interface which was assembled by using a cellpsilas own locomotion force. This interface was designed for large scale intracellular recording for development of an artificial synaptic device. We previously demonstrated a method to insert a nanostructure into a living cell using cell locomotion. To achieve an intracellular nanoelectrode, we employed such cell migration on an extracellular matrix as the driving force to insert a nanoelectrode into a plasma membrane. In this study, we describe intracellular nanoelectrodes inserted by the cell migration force which are used to construct intracellular recording devices. Each microwell had a low cell binding glass plate which had cellular adhesive molecules, and there was an electrically conductive tungsten nanoneedle about 190 nm in diameter on the bottom of the microwell. Cells can adhere only in the microwell; thus they are pulled down by their own body and are inserted into the nanoneedle by their own migration force. Then, the living cellular activity can be measured from the electrically conductive nanoneedle. Using this concept, we attempted to achieve a long-lasting intracellular multi channel interface between living cells and artificial implements without making a precise mechanical alignment and without an invasive procedure. This report explains the fabrication and electrical characteristics of the interface for development of the physical part of the cell-machine interface. [C318]

"Magnetic resonant cavity composing of a three layered plasmonic nanostructure"

The magnetic-type plasmon resonant of a metal-dielectric-metal nanocavity working at the wavelength of 1.55 mum is explored, in which the upper layer is periodically patterned with metallic nanostrip arrays. In the dielectric film layer, the magnetic energy intensity is enhanced about 1700 times when irradiated with a p-polarized plane

wave. We numerically studied the dispersion of the modes and the Q-value of this periodic cavity arrays. Q value is estimated about 18 and still has room for further improvement. It provides a new type of nanocavity that exhibits a strong magnetic response. [C319]

"Characterization of nanocrystalline ZnO grown on silicon substrates by dc reactive magnetron sputtering"

The aim of the work was to study the effect of postgrowth thermal annealing processes on the characteristics of the zinc oxide films grown on silicon substrates by dc reactive magnetron sputtering. The growth temperature of the ZnO thin films was fixed at 230degC and then the samples were annealed in dry air atmosphere at 800degC for one hour. The surface of the ZnO samples was analyzed with a scanning electron microscope (SEM) and using an atomic force microscope (AFM). The structural properties were assessed by X-ray diffraction (XRD), Raman scattering, and Photoluminescence (PL) measurements. The XRD and Raman studies revealed the ZnO films crystallizes in the wurtzite structure with a certain amount of amorphous material in the as-grown films, after the thermal treatment a preferential orientation along the c-axis was observed. The films are constituted by crystallites of similar nanosize dimensions in spite of high temperature used in the annealing process. The most relevant result of this study was the observation of excitonic-like transitions in the PL response at the near band gap region at room temperature. The PL response also shows a broad defect-related green band at 516 nm. Both bands are clearly linked to the nanostructure and the point defects content of the ZnO films. [C320]

"Controllable nanofabrication based on the interference of surface plasmons"

Metamaterials open new vistas in optics, whose properties are engineered by controlled by their nanostructure, now one of the most captivating efforts is how to fabricate this new class of materials. The potential of using surface plasmons (SPs) to manipulate light in the subwavelength space opens up a multitude of new possibilities for subwavelength lithography. In this paper, localized surface plasmon nanolithography (LSPN) technique using the significant localization characteristic of SPs is proposed and demonstrated to produce patterns with a sub-wavelength line width; moreover, the localized energy at the very taper tip can be modulated merely via beforehand programming and reasonably controlling the corresponding interference of SPs which are excited by two distinct structures, namely, the grating and the nanotaper. Detailedly speaking, the localized energy can be modulated consecutively with a constant periodicity, and the modulation range of energy is extremely wide, for instance, the maximum energy is nearly 3 orders of magnitude larger than the minimum by our FDTD simulation results. It suggests a potential way to produce patterns with different depths and critical widths in one chip. [C321]

"Fabrication of nanostructured PLGA scaffolds using anodic aluminum oxide templates"

PLGA (poly(lactic-co-glycolic acid)) is one of the most used biodegradable and biocompatible materials. Nanostructured PLGA even has great application potentials in tissue engineering. In this research, a fabrication technique for nanostructured PLGA membrane was investigated and developed. In this novel fabrication approach, an anodic aluminum oxide (AAO) film was use as the template; the PLGA solution was then cast on it; the vacuum air-extraction process was applied to transfer the nano porous pattern from the AAO membrane to the PLGA membrane and form nanostures on it. The cell culture experiments of the bovine endothelial cells demonstrated that the nanostructured PLGA membrane can double the cell growing rate. Compared to the conventional chemical-etching process, the physical fabrication method proposed in this research not only is simpler but also does not alter the characteristics of the PLGA. The nanostructure of the PLGA membrane can be well controlled by the AAO temperate. [C322]

"High temperature synthesis of In-doped ZnO nano-structures on InP (001) substrate by pulsed laser deposition"

ZnO nanostructures were grown on InP (001) substrate to achieve the In-doped ZnO nanostructure by pulsed laser deposition technique at high temperature. The FE-SEM images showed that the nanostructures grown at different temperatures have distinct dissimilar structures, and the morphology became better with increasing substrate temperature. The results of XRD showed that In element from InP substrates diffused into the ZnO layer to form In-doped ZnO nanostructures at the high temperature above 500Г‚В°C. Energy dispersive chemical analysis (EDAX) is taken to ascertain the component of the nanostructure grown. [C323]

"First-principles study on inversion layer properties of double-gate atomically thin silicon channel"

Recent progress of semiconductor technologies requires deep understanding on the device physics in the nanometer scale. Several pioneering researchers studied the nanometer-scale Si structures by the first-principles

calculation method and succeeded to predict its significant reduction in the dielectric constant for the structure smaller than 3 nm. Those studies however could not discuss deeper device physics of the field effect transistors (FET) when the structure is used for the FET channel, because their method cannot calculate the charged up structures under the external electric field. We have thus developed a new first-principles method so called the EFED method. Based on this method, we discuss the inversion layer properties of a simple Si nanostructure as the first step. [C324]

"Electromechanical imaging of biological systems with sub-10 nm resolution"

Piezoelectricity in calcified and connective tissues has been known for over half a century following seminal works by Fukada. Traditionally, complex hierarchical structure of these materials, spanning the length scales from nanometers to millimeters, precluded quantitative studies, and hence elucidation of biological significance of biopiezoelectricity. Here, we demonstrate an approach for electromechanical imaging of structure of biological samples on the length scales from tens of microns to nanometers using piezoresponse force microscopy (PFM). In this method, intrinsic piezoelectricity of biopolymers such as proteins and polysaccharides is the basis for high-resolution imaging. Nanostructural imaging of a variety of protein-based materials, including tooth, antler, and cartilage is demonstrated. Visualization of protein fibrils with sub-10 nm spatial resolution in a human tooth is achieved. Given the near-ubiquitous presence of piezoelectricity in biological systems, PFM is suggested as a versatile tool for micro- and nanostructure imaging in both connective and calcified tissues. In the second part of the talk, I discuss recent advances in bioPFM, including imaging in liquid environments, resonance-enhanced PFM, and electrically shielded probes required to probe a broad range of electrophysiological processes from membrane flexoelectricity to cardiac miocyte activity. [C325]

"A novel design of nano layered optical, filter using photonic band gap materials"

Much interest has been drawn in Photonic crystal, which are novel nanostructure of light. In the present paper, we present how the emerging technology of Photonic crystal can be suitably exploited to design and make a nano sized tunable optical falter. A novel theory to design tunable optical filter using one dimensional nano photonic structure is proposed in this present paper far ultraviolet and visible region of wavelength. A periodic structure of different dielectric and semiconductor materials (i.e. air and GaAs, air and Ge) are used. This idea is based on the Kronig -Penny model in the band theory of solids. [C326]

"Surface-enhanced Raman-scattering biosensor on nanoparticle island substrates for DNA detection"

Summary form only given. This work presents a systematic study of the surface-enhanced Raman-scattering (SERS) properties of nanoparticle island substrates (NIS) and their application for oligonucleotide target detection. Using NIS that are structurally well characterized by atomic force microscopy (AFM) and UV-VIS extinction spectrum, it demonstrates the correlation of nanostructure of substrates and extinction maximum (Г‚Вїmax) of substrates fabricated on different conditions, i.e. thickness of metal Ag. To effectively implement SERS on NIS and find out optimal condition for DNA detection, the relationship between extinction maximum (Г‚Вїmax) and SERS enhancement factor (EF) was explored in detail. In fact, this work demonstrates high S/N ratio SERS spectra can be achieved for NIS with Г‚Вїmaxwithin a spectrum window (~60 nm) consisting by the excitation wavelength (514 nm) and the scattered Raman wavelength, and highest EF measured is about 4 ГґВ — 108with thickness of Ag being 50 A. Detection of oligonucleotide target has been performed with a sandwich assay scheme. In this scheme a layer of thiol modified receptor oligonucleotide was assembled on NIS and 3' of oligonucleotide probe has been labeled with a Raman-active dye. Furthermore, We compared the detection performance of strategies using probe oligonucleotide with or without gold nanoparticles (Au-NPs, 20 nm) capped on 5'. The experimental results reveal that the DNA detection implemented with NIS can provide high sensitivity, and both dynamic range and diction limit can be amplified with the aid of Au-NPs on 5' of probes. The current detection limits of NIS with and without Au-NPs are 0.4 femtomolar and 1 nanomolar respectively. [C327]

"Exploring low temperature ZnO nanowires in display and solar cell applications"

Applying ZnO nanowires for e-paper, field emission display and dye-sensitized solar cell is reported. Firstly, we report an electrochromic (EC) e-paper using a viologen-modified ZnO nanowire array as the EC electrode. The ZnO nanowire array was grown directly on an indium tin oxide (ITO) glass by a low temperature aqueous thermal decomposition method and then modified with viologen molecules. The ZnO nanowire electrochromic device shows fast switching time, high coloration efficiency and good stability. Secondly, we reported a triode configuration FE based on ZnO nanotetrapod and MgO nanoparticle paste. The emission is based on a surface conduction mechanism. The device has an efficiency of close to 100%. Lastly, we report a ZnO

nanoflower/nanowire based dye-sensitized solar cell (DSSC). Using commercial available dye (N719), we obtained an efficiency of 1.9%. We further applied this low temperature ZnO nanowire on flexible substrate to realize a flexible DSSC. Based on our research, ZnO nanostructure has great potential in the area of displays and solar cells. [C328]

"Fabrication of double nano-cup assemblies and their anomalous plasmon absorption"

Double-cup assemblies of nanoscale gold semi-shells have been synthesized using a combination of thermal evaporation and chemical etching. The optical extinction of these structures peaked at 740 nm, but there was also evidence of additional extinction maxima at 560, 940 and 1110 nm. Numerical simulations of the optical properties revealed that the extinction was due mainly to scattering rather than to absorption In contrast, the extinction in simple single-shell nanocups was strongly absorptive in nature. Multiple plasmon resonances were identified in the double-cup structures, including an interesting quadrupole resonance in which oscillations of the inner and outer shells should operate 180deg out-of-phase. [C329]

"Anodization process of aluminum microelectrode for a single-electron transistor operating at room temperature"

A technology for fabricating nanostructures has been extensively studied in order to develop electronic or photonic devices based on new types of mechanisms such as quantum effects. There are generally two complementary approaches to fabrication of nanostructures. One is a top-down process as typified by a lithography technique widely used in LSI technology and the other is a bottom-up process such as a self-organization process. In the case of the conventional lithography technique, it is not easy to fabricate nanostructures although it is suitable for controlling their positions. In contrast, a self-organization process does not control positions of nanostructures though it can easily produce nanostructures. Therefore, it is important to develop a hybrid technique of these complementary techniques. [C330]

"Photodetection in the non-fluorescent regime with gold nanostructures"

Photodetection techniques in the non-fluorescent regime when combined with nanotechnology offer promising new angles in diagnosing diseased conditions over conventional fluorescence-based imaging. In this study, we developed two types of spherical gold nanostructures: gold nanoshells and gold nanoparticles and used them to enhance optical backscattering signal in confocal reflectance microscopy and OCT as well as Raman signal in Raman spectroscopy respectively. The gold nanoshells were conjugated to anti-EGFR for targeted molecular imaging and the gold nanoparticles were made to self-assembled using a novel drop-dry approach to form a SERS-active monolayer film. We have shown that the gold nanoshells can elicit an optical contrast based on molecular expression of EGFR to discriminate cancer from healthy cells under confocal reflectance microscopy as well as to improve the OCT signal over tissue phantoms that model intrinsic tissue scattering. The SERS-active gold nanoparticles film have also shown to enhance Raman signal in molecular analytes and enabled the SERS spectra of saliva from to be distinguishable from healthy individuals to a specificity of 70%. These results have demonstrated the additional diagnostic values provided by gold nanostructures in existing non-fluorescence based photodetection techniques. [C331]

"Lasing characteristics of ZnO nanostructures with various morphologies"

Semiconductor nanostructures are very promising for future photonic devices owing to their unique optical properties which are quite dependent on their morphology. We report lasing characteristics of ZnO nanostructures with various morphologies including nano-wire, nano-taper, porous nano-wires, and nano pencils. Single crystalline ZnO nanostructures are synthesized using chemical vapor transport and condensation (CVTC) or aqueous reaction. Nonlinear optical properties of nanostructures are investigated. Optical pumping of ZnO nanostructures is carried out using micro photoluminescence (u-PL) system with the frequency-tripled output (355nm) of a Nd:YAG laser (repetition rate of 10 Hz and 6 ns pulse width). We observe an enhancement in laser emission intensity as the morphology of the nanowire changes the facet structure to porous structure. The variation of optical properties can be explained in terms of modified emission rate in ZnO nanowires with large surface area. [C332]

"Fabrication and characterization of Nitride base photodiodes with nanostructure"

In this study, we achieved nanoscale InGaN self-assembled quantum dots (SAQDs) in the well layers of the active region by using an interrupted growth method. And then nitride base photodiodes with nanostructure were successfully fabricated by metal-organic chemical vapor deposition (MOCVD) growth. It was found that the turn on voltage in forward bias and the break down voltage in reverse bias are about 3 and -13.5 V, respectively. The RT PL spectrum peak position for the fabricated InGaN/GaN multi-QDs p-n junction PDs is located at 464.6

nm and FWHM is 24.2 nm. Furthermore, with 1 V to 3 V applied bias, the maximum responsivity of the fabricated multi-QDs p-n junction PD was observed at 350 nm, and the minimum of spectral response was measured at 465 nm. It was also found that the responsivity was nearly a constant from 390 to 440 nm It seems to suggest that the spectral response in the range of 390-440 nm is due to the effect of the InGaN dots in a well active layers. [C333]

"Enhanced ultraviolet photo-response of nanostructure zinc oxide (ZnO) thin film irradiated with pulsed laser"

Ultravoilet (UV) photodetectors have been fabricated by rf magnetron sputtered ZnO films. The average grain size of ZnO films were 15-20 nm. Photo-response (Ion/Ioff) of as-grown ZnO film of thickness 100 nm was maximum (3.8 times 103) having relatively small response time ~90 ms for UV intensity of 140 muW/cm2(lambda= 365 nm). ZnO films were irradiated by pulsed Nd:YAG laser corresponding to both fundamental wavelength (1064 nm) and forth harmonics (266 nm) to modify its defects profiles. Response was found to increase with increasing number of irradiating pulses upto 6000, and thereafter starts decreasing. Laser (lambda=266 nm) irradiated detector exhibits enhanced response (3.7 times 104) with fast response speed (30 ms), showing its promising application for detection of low intensity UV photons. [C334]

"Theory of transport and photon-statistics in a biased nanostructure"

We present a microscopic description of transport and photoluminescence for a QD in a cavity, tunnel coupled to electronic reservoirs. A cluster expansion is used to account for carrier-matter correlations. In particular we study the influence of the reservoir statistics on the intracavity photon autocorrelation function. [C335]

"Tracking Nanostructural Evolution in Alloys: Large-Scale Analysis of Atom Probe Tomography Data on Blue Gene/L"

The advent of Local Electrode Atom Probe (LEAP) tomography is revolutionizing materials science by enabling near atomic scale imaging of materials. Analysis of three-dimensional atom probe tomography (APT) data holds the promise of relating combinatorial arrangement of atoms to material properties and enable better design and synthesis of complex materials. Existing techniques, which are serial and require O(n2) work for n atoms, do not scale to the hundred million large data sets produced by current generation atom probe microscopes. In this paper, we present an O(n) work autocorrelation based technique that reveals clustering of constituent atoms and spatial associations between them. We present an efficient parallelization of this method and show scaling on a 1,024 node Blue Gene/L. To our knowledge, this is the first parallel algorithm for the analysis of APT data, and together with our linear work autocorrelation technique, is demonstrated to easily scale to billion atom data sets expected in the very near future. [C336]

"ZnO nanostructured arrays grown from aqueous solutions on different substrates"

ZnO nanostructures were grown from a solution of zinc nitrate hexahydrate and hexamethylenetetramine onto different substrates that were pretreated with an RF sputter coated ZnO seed layer. The choice of substrate was observed to have a direct effect on the morphology, orientation and surface coverage of the nanostructured arrays. Substrates that were covered in a 1.2 mum sputter coated ZnO seed layer, include; 6H-SiC, LiNbO3, gold, LiTaO3, ITO (indium tin oxide) glass and plate glass. The ZnO seed layer facilitates the uniform growth of nanostructured arrays of ZnO, without such a layer nanostructure growth was found to be sporadic and unaligned. Under identical reaction conditions, a range of different ZnO nanostructured arrays were observed. [C337]

"NO gas sensor of PEDOT: PSS nanowires by using direct patterning DPN"

Nitric oxide (NO) detection is a critical issue for environmental safety and medical diagnosis due reasons with regard to the toxic properties for human body and metabolic index for respiratory disease, respectively. Development of gas sensor with high sensitivity is very important because the concentration of NO gas in the environment and respiratory tract is extremely low, therefore not readily detectable. The material with nanostructure can improve the sensitivity of sensor owning to surface effect and size effect. Herein, we developed a new type of gaseous nanosensor assembled by 34 nanowires of conducting polymer, PEDOT: PSS. The nanowires were fabricated by dip pen nanolithography (DPN) with the length of 55 um and diameter of 300 nm between golden wires. The NO gas measurement is based on chemiresistor based methods. The result of dynamic measurement of NO gas at 100 ppm shows repeatability and stability; the recovery time is 10.4 minutes. Moreover, the lowest concentration of NO gas in static measurement is 10ppm at 80 C, which also shows the ability sensing at low temperature. [C338]

"Microstructural stability and microhardness of ultrafine grained and nanostructured Cu-5vol.%Al2O3 composite lumps/powders produced by high energy mechanical milling"

Ultrafine grained lumps and a nanostructured powder of Cu-5vol%Al2O3composite were produced using two high energy mechanical milling routes respectively. The milled composite materials were heat treated at 150, 300 and 500 degC for 1 hour, respectively, to determine the microstructural stability and micohardness changes of the materials as a function of the heat treatment condition. For the Cu-5vol.%Al2O3composite lumps produced using route 1 (12 hours milling), after heat treatment at 150 degC, the Cu grain sizes decreased from the range of 100-250 nm to the range of 50-180 nm due to recrystallisation, but its average microhardness also decreased from 224 HV to 212 HV due to reduction of dislocation density. For the 24 hours milled Cu-5vol%Al2O3powder produced using Route 2, the Cu grain sizes increase slightly from the range of 40-180 nm to the range of 50-200 nm, and as the result of this grain coarsening and decrease of dislocation density, the average microhardness decreased from 270 HV to 257 HV respectively. Further increasing the annealing temperature to 300 degC caused the grain sizes of the 12 hours milled lumps to increase to the range of 50-350 nm, and those of the 24 hours milled powder to 60-300 nm, both resulting in a decrease in the average microhardness to 207 HV for the lumps and 248 HV for the powder. Increasing the annealing temperature from 300 to 500 degC caused a much more significant increase of the Cu grain sizes of both the lumps and the powder, and a significant decrease in the microhardness of the 24 hours milled powder particles to 216 HV. However, the microhardness of the lumps decreases very little to 196 HV, suggesting the significant reinforcement effect of the Al2O3nanoparticles. [C339]

"A Two-Step Hydrothermal Method for Preparing Titania Nanostructure with High Surface Area"

Anatase titania with high surface area and distinctive morphology was prepared by a two- step hydrothermal method. In the first step, titanate nanotubes (TNTs) were produced from hydrothermal treatment of rutile titania in NaOH solution. Then the TNTs were hydrothermally treated in de-ionized water and transformed to rice-shaped anatase titania with specific surface area of ca. 80 m2/g. Based on microscopic analysis, the reaction-assisted phase transformation could be attributed to crystallization of the agglomerated amorphous TNTs in the presence of water molecule. [C340]

"Correlating Microstructure with Switching Field Distribution in Nanomagnetic Systems with Transmission Electron Microscopy"

We examine how nominally identical nanostructure can exhibit different switching behaviors in two model systems. The first system consists of an array of perpendicularly magnetized Co/Pd multilayer nanodots. We found that the non-uniformity in switching fields among the nanodots in an array is due to a single grain of weak uniaxial anisotropy. In the second system consisting of in-plane magnetized Permalloy nanodot arrays, we found that edge roughness plays an important role in the switching uniformity of the nanodot array. [C341]

"Effect of Contacts on Quantum Transport in Nanostructures"

In quasiballistic nanoscale devices, the process of relaxation towards a steady state cannot be attributed to carrier scattering. Rather, carrier exchange between the active region and the rapidly dephasing contacts is the mechanism governing relaxation. In this paper, we present a novel technique for the treatment of quantum transport in quasiballistic semiconductor nanostructures. The approach utilizes a first-principles model interaction between the current-limiting active region and the contacts. With the use of the model interaction and by accounting for the energy relaxation in the contacts due to the electron- electron interaction, irreversible evolution of the active region's many body statistical operator is derived in the Markovian approximation. Specifically, analytical steady-state distribution functions are derived for a generic two-terminal nanostructure, and used to obtain the steady-state I-V curves for the cases of a resonant-tunneling diode and an nin diode. [C342]

"Fabrication of Large-Area Nanostructure Arrays Using Aperture Array Lithography"

We have developed a technique for the rapid prototyping and fabrication of nanostructure arrays over large areas and with precisely controlled geometries. Our approach, aperture array lithography, uses energetic particles (typically He+, 5-30 keV) to expose resist through a stencil mask that contains a large array (108-109openings/cm2) of circular apertures. The mask is placed in close proximity to the substrate and can be scanned over the surface with nanometer-scale displacement to change the shape, density, and size of the printed patterns. This flexibility is well-suited for rapid prototyping of a variety of structures, including bit-patterned medium, solid-liquid separation filters, infrared bandpass filters, and ion lens arrays. [C343]

"The Effect of Size Distribution on the Switching Field Distribution of Co/Pd Multilayered Nanostructure Arrays"

We use Ion Beam Proximity Lithography (IBPL) to produce 4 mm times 4 mm arrays of 220 nm dots in perpendicularly-oriented Co/Pd multilayered media. IBPL is used to reduce the size distribution sigmaDof the arrays, and subsequently He+ion irradiation is used to reduce their anisotropy. The switching field distribution sigmaHcr/HCris measured for each sample before and after irradiation, and a linear relationship is experimentally found between sigmaHcr/HCrand sigmaD. We argue that the slope of the line is due to the self-demagnetization effect of individual dots (and therefore, it is not strictly a line) and that the intercept of the line is inversely proportional to the permeability of the nanostructured material. [C344]

"Magnetic Annular Nanostructure Fabrication Using Ion Beam Proximity Lithography"

We describe the fabrication of large-area magnetic ring structures using ion beam proximity lithography (IBPL) to pattern an array of circular openings and then use a conforming oxide coating to define the ring structure through the sidewall coating. Arrays of Permalloy rings with sub 500 nm outer diameter and 150 nm inner diameter on a 650 nm pitch over a 5.5 mm times 6 mm area were fabricated to study transitions between the micromagnetic configurations within these structures. The results suggest that the field required for onion-to-vortex transition and field required for vortex-to-onion transition to be 0Oe and 400Oe, respectively. [C345]

"Carbon nanotube (CNT) filled adhesives for microelectronic packaging"

This project evaluated the use of carbon nanotubes as a filler in electrically conducting adhesives in order to enhance the electrical, mechanical and thermal performance. As the carbon nanotubes caused a marked increase in the viscosity of the adhesive, a low viscosity polymer matrix (< 100 mPas) was chosen. This allowed a high CNT content. Multi-wall carbon nanotubes (MWNTs) were chosen for the experiments because these are available in favorable quantities and at reasonable prices. In order to enhance the dispersion properties, the MWNTs were also treated chemically via ozone/UV and low pressure plasma. For mixing the MWNTs into the polymer matrix different methodologies were tested. Ultrasound was found to be a very effective method, but the dispersion energy drops dramatically when viscosities above 10,000 mPas are reached. Hence high viscosity adhesives were treated using a calander as described in [1]. In general, good dispersion could be achieved by applying combinations of these two dispersion techniques. Adhesives were produced with varying CNT content, different CNT types and using different dispersion techniques. The influence of these parameters on the electrical resistance, thermal conductivity, impedance behavior and mechanical strength was investigated. In parallel, many samples were analyzed by TEM in order to get detailed knowledge of the adhesive nanostructure and learn how this structure is influenced by the above- mentioned parameters. Furthermore, the absorption of microwave radiation by the samples was investigated in order to further our understanding of microwave absorption by CNT-filled composites. Based on these results, the two standard formulations showing the best performance were chosen for bonding SMD components on a test assembly. For the curing of the adhesives two methods were used: Curing by microwave radiation and curing in a conventional oven at 130degC. Whilst the conventional curing took 30 minutes, it was possible to comp--letely cure the adhesives using microwave radiation in only 3 minutes. Finally, the bonded assemblies were subjected to a system integrity test. The mechanical stability of the adhesive bonds showed very high resistance to ageing after exposure to humidity and after 1000 thermal cycles. [C346]

"Computer microwave diagnostic system for measurement of parameters of sandwich-like micro- and nano-structures"

The Computer Diagnostic System for measurement of parameters of sandwich-like metal-dielectric and metal-semiconductor micro- and nano-structures from the reflection and transmission microwave spectra, developed in Saratov State University, is presented. [C347]

"MEMS composite porous silicon/polysilicon cantilever sensor for enhanced triglycerides biosensing"

A novel composite porous silicon/polysilicon microcantilever for biosensing applications with enhanced sensitivity is reported. It is fabricated by surface micromachining of polysilicon cantilevers followed by the formation of the surface porous layer after release by Reaction Induced Vapor Phase Stain Etch. The microcantilevers with porous surface layer are characterized by their morphology that exhibits a dual macro and nanostructure for very effective immobilization of biomolecules. The current work focuses on the fabrication of composite porous silicon/polysilicon microcantilevers, characterization of their morphology and demonstration of improved immobilization of enzymes resulting in enhanced sensing of triglycerides. [C348]

"Integral and integrodifferential equations for quasiperiodic structures"

Periodic structures (PSs) are interesting for many categories and fields of physics and chemistry, so correspondingly there is tremendous number of works devoted to their analysis. PSs describe different physical phenomena [1]. Especially it is concerning towards following areas: crystalline semi-conductors and metals in solid-state and semiconductor physics [2], slow-wave structures (SWS) and periodic waveguides in electromagnetics and electronics [3], crystals in crystal optics [4], photonic crystals (PC) [5,6], periodic metamaterials (artificial media) [7] in electrodynamics, optics, and acoustoelectronics, X-ray and particle diffraction by crystals. So, recently the considerable interest to PPS arose in different branch of knowledge (electronics, slow-wave, electrodynamic PC and metamaterials structures, photonics, optics, nanostructure physics). It is caused by the development of nanotechnology and also by such circumstance, that PS is the mathematical abstraction, and all real structures are the PPSs. The violation of periodicity arises owing to number of circumstance. The main is the finiteness of all real structures. This principal factor is essential here when the number of periods is not large. Its influence is sharply decreasing when the number of periods increases over a certain value, and the PPS is inherently similar (in the internal regions) to PS one. The periodicity-breaking factors also are the nonstationarity (aperiodicity) in time, the loss and amplification (generation). Notice, that in finite passive (lossy) or active PC and SWS structures the eigenfrequencies are complex. It means the time aperiodicity i.e. the nonstationarity. [C349]

"Field electronic spectroscopy of nanostructures"

In work coverings nanopowders of diamond and zirconium, put on tungstic edges, are investigated by methods of field emission spectroscopy. Power electrons distributions depending on size of an electric field at a surface of the cathode are received. Besides it work of an output for system W-C and for system W-ZrO2is estimated. [C350]

"3D-nanocomposite (The lattice packages of the SIO2 nanospheres) with Ni-Zn-Fe spinel nanoparticles"

Interaction of electromagnetic waves with nanoheterostructures obtained by doping of opal matrixes with nickel-zinc and manganese-zinc ferrite has been studied. The opal matrixes contain of SiO2nanospheres with diameter about 250 nm with ferrite nanoparticles in the nanosphere voids. The measurements are carried out in frequency range from 26 to 38 GHz in magnetic fields up to 30 kOe. Variation in magnetic field of the transmission coefficient module of the H10mode in rectangular waveguide containing a doped opal matrix is studied. The nanoheterostructure sample is placed into the waveguide. Field dependencies of the transmission and reflection coefficients are analyzed. It has been shown that the magnitude and the field dependences of the coefficients are similar each other. [C351]

"Simulation of EM wave propagating in a nanowire-base localized surface plasma resonance sensor"

We studied the dependence of the sensitivity in a localized surface plasmon resonance with the nanostructure. An localized magnetic surface plasmon resonance was modeled in a two nanowires with underlying gold thin film connection. The results show has high electric fields exist between the wire edges indicating a strong displacement current flowing anti-parallel along the wire. This current will generate magnetic field concentrated in the space between the wires. The response of the nanowire based array resembles the behaviour of single pair nanostructure, then exhibits huge intensity enhancement at the excitation frequency and contributes the sensitivity. Localized surface plasmon modes can be excited when the wire diameter is approximately equal to the skin depth, and the wire-pair is separated to a applicable distance. [C352]

"Application of Atmospheric-Pressure Plasma for Enhancing Photoelectrochemical Properties of TiO2 Electrodes"

A synergistic combination of nanostructure synthesis and surface engineering was used to enhance photoelectrochemical activity of TiO2photoanodes. Titania (TiO2) nanotubular arrays were synthesized by electrochemical anodization of Ti thin foils. A combination of atmospheric-pressure helium plasma and nitrogen exposure was used to modify the surface properties of TiO2nanotubes. The photocurrent from plasma treated samples was approximately 25% higher than untreated samples. This increase in photoactivity could be ascribed to (1) increased absorption of visible light due to bandgap reduction, (2) efficient charge separation, (3) production of optimal oxygen vacancies, and (4) increased surface area and hence enhanced electrode-electrolyte area to provide maximum optical adsorption and efficient charge transfer. The diffused reflectance ultraviolet-visible (DR-UV-Vis) absorption spectra indicated a marginal increase in absorbance for the plasma

treated samples in the visible region suggesting a change in surface electronic structure even though bulk electronic properties remain unchanged during plasma treatment. [C353]

"Quasi-supercontinuum interband lasing characteristics of quantum dot nanostructures"

We present the first analysis of wideband-stimulated emission in semiconductor quantum-dot laser. Our theoretical model reveals critical occurrence of broadband lasing when the energy spacing between quantized energy states (DeltaE) is comparable to dot inhomogeneity. [C354]

"625 nm wavelength vertical-external-cavity optical-pumped laser based on GaInP/AlGaInP nanostructure with DBR mirror"

A pulse (5 ns) semiconductor laser based on a GaInP/AlGaInP multi quantum well (MQW) structure with an AlAs/AlGaAs distributed Bragg reflector (DBR) and an external mirror was realised under optical pumping by emission of a frequency-doubled Q-modulated diode-pumped Nd-YAG laser. Lasing occurred at a wavelength of 625 nm in TEM00mode with a peak output power of 3.1 W at a repetition rate of 6 kHz. [C355]

"Ellipticity and spurious solutions in k p calculations of III-nitride nanostructures"

We analyze the ellipticity of the standard kldrp Wurtzite model for the symmetrized and the Burt-Foreman operator ordering. We find that the symmetrized Hamiltonian is unstable, leads to different results and can cause spurious solutions. We show that the operator ordering in Wurtzite must be completely asymmetric to be stable. The asymmetric operator ordering is elliptic and therefore no spurious solutions are obtained. [C356]

"A novel nanocomposite and its application in repairing bone defects"

Many commercial bone graft substitutes (BGS) and experimental bone tissue engineering scaffolds have been developed for bone repair and regeneration. Among them, sol-gel processed bioactive glasses showed promise due to their unique nanostructure. This study reports the in vivo bone regeneration using a newly developed porous bioactive and resorbable nanoscomposite that is composed of nano-bioactive glass (BG), collagen (COL), hyaluronic acid (HYA) and phosphatidylserine (PS), BG-COL-HYA-PS. The nanocomposite was prepared by a combination of sol-gel and freeze-drying methods. A rabbit radius defect model was used to evaluate bone regeneration at time points of 2, 4 and 8 weeks. Techniques including radiography, histology, fluorescent marker, and micro-CT were applied to characterize the new bone formation. In addition, ectopic bone formation was also investigated for the osteoinductivity of the materials. 8 weeks' results showed that (1) nearly complete bone regeneration was achieved for the BG-COL-HYA-PS nanocomposite that was combined with a bovine bone morphogenetic protein (BMP); (2) partial bone regeneration was achieved for the BG-COL-HYA-PS composites alone; and (3) control remained empty. This study demonstrated that the novel BG-COL-HYA-PS nanocomposite with or without the grafting of BMP, is a promising BGS or a tissue engineering scaffold for non-load bearing orthopaedic applications. [C357]

"Self-assembly of 2D ordered silver nanoparticle arrays on triblock copolymer templates"

Poly (styrene-b-butadiene-b-styrene) (SBS) triblock copolymer templates which present 2D ordered perforated pattern have been prepared by solvent-induced order-disorder phase transition method. By low energy clusters beam deposition (LECBD) apparatus silver clusters have been obliquely deposited onto the SBS copolymer templates. The morphology of the samples has been characterized by a tapping-mode AFM. It is shown that silver nanoparticles form 2D ordered arrays and the interparticle distance of the 2D ordered array is comparable to the particle size. Optical absorption spectra reveal that the surface plasmon resonance (SPR) of 2D ordered silver nanoparticle arrays occurs at 436.1nm. It is mainly due to the interaction of siver clusters with the exciting light at their surface plasmon frequency and electrodynamic interactions between silver clusters. The surface-enhanced Raman spectroscopy(SERS) spectrum shows the electric field enhancement that occurs in the vicinity of interacting silver nanopraticles. Hence the assembly of metal-copolymer nanostructure transcends the spatial limits of lithography and provides a promising route to achieve well ordered nanostructures. [C358]

"Nanostructures study on power transformer insulation paper under electrical and thermal stresses"

In this paper, in order to analysis the nanostructures varieties and ageing mechanism of power transformer insulation paper under electrical and thermal stresses, both Atomic Force Microscope and MS 4.0 software were used to analysis the microscopic figure variation of insulation paper during thermal and electrical ageing. The results indicate that in some parts, paper sample was punctured because of the flow of discharge current which destroyed the compact cellulose chains structures and the diameter of punctures is about 0.5 nm. In addition, this paper analyzed the influence to the physical chemistry characteristics of insulation paper caused by partial

discharge and paper ageing. [C359]

"Rapid, localized synthesis of titanium-based nanoswords on MEMS"

Herein, we report the discovery of a uniquely-shaped, titanium-based nanostructure called a "nanosword," utilizing MEMS as the platform and using a rapid and localized induction heating system. The simple synthesis technique yields high-quality nanostructures with a rare shape that is broad and flat, tapering to a sharp tip with a curvature as low as 2 nm. Sans catalyst and self-sourced from an evaporated layer of titanium, they are synthesized in only 2-5 minutes by the selective heating of ring-shaped microstructures. Growth rates were observed to be 1- 2 mum/min and increases in both the nanosword quality and density were observed by increasing the synthesis temperature and source material volume, respectively. The resistivity averaged 0.192Omega-cm. Such high-quality, sharp-tipped nanostructures could be used in applications like nanoswitches, nanocantilevers, nanoprobes, or plasmonic applications such as surface-enhanced Raman spectroscopy and apertureless near-field scanning optical microscopy. [C360]

"Titanium-based nanoswords: Synthesis and characterization"

In this work, we report the discovery of a novel, titanium-based nanostructure, a "nanosword," that may be quickly and easily synthesized in bulk using an induction heating system. The nanoswords are high-quality, single-crystalline structures that are synthesized without catalysts. The self- sourcing, vapor-solid synthesis technique presented is quick, with synthesis occurring in as low as five minutes, and simple, necessitating only a thin-film of evaporated titanium. Using scanning electron microscopy and transmission electron microscopy, the observed thicknesses of the nanoswords were 200-700 nm, widths were 20-60nm, and lengths were up to 5 mum. The ends of the nanoswords taper at an angle of 78-82deg to a sharp tip with radius of curvature as low as 2nm at an angle of 110- 114deg. Strong peaks of titanium and oxygen were observed in the energy dispersive x-ray spectroscopy. The reaction temperature was observed to influence the nanosword structure, with the best synthesis occurring at approximately 890degC. Three-point bend tests were performed using an atomic force microscope, and the average modulus of elasticity was measured to be 177 GPa. The nanosword structures, with their unique shape, repeatable crystallinity, and simple synthesis technique may be used as field emitters, nanobioprobes, nanoswitches, or for plasmonic applications, such as apertureless near-field scanning optical microscopy tips or localized surface enhanced Raman spectroscopy. [C361]

"Annealing effect on the microstructure and morphology of the nanostructured Ta-Si-N thin films"

Ta-Si-N thin films were potentially applied as diffusion barriers for Cu interconnections. However, the thermal stability of Ta-Si-N is related to the composition and annealing methods. In this paper, we have investigated the effect of high- vacuum furnace annealing and vacuum rapid thermal annealing (RTA) on the microstructure and morphology of different nanostructured Ta-Si-N thin films fabricated by reactive cosputtering at varied Ta and Si powers and nitrogen flow ratio (FN2%= FN2/(FN2+FAr) x 100%). As Si is added to the Ta-N compound to form Ta-Si-N, the microstructure becomes nanocrystalline grains embedded in an amorphous matrix i.e. amorphous-like microstructure, which is also affected by the nitrogen flow ratio. Amorphous-like Ta-Si-N films obtained at small 3-6 FN2% had smoother morphology and lower resistivity compared to the polycrystalline film at high 20 FN2%. The thermal stability of Ta-Si-N films increases with the Si/Ta ratio and magnitude of vacuum. Higher vacuum furnace annealing at 5 times 10-5Torr may make both amorphous-like and polycrystalline Ta-Si-N films enduring higher temperature up to 900degC for a longer time of 1 h while the higher pressure RTA at 2 times 10-2Torr make Ta-Si-N films transform of phase and morphology at 750-900degC just in 1 min. The increase of Si/Ta ratio may also increases the stability of Ta-Si-N films. [C362]

"Near-field images of surface plasmon eigenmodes in gold nanogratings"

In this study, we have fabricated gold nanograting structures by using a focused-ion-beam system. The nano-optical properties were examined by using both the scattering- and transmission-mode near-field scanning optical microscope (NSOM). The surface plasmon (SP) eigenmode in this periodic nanostructure is directly observed by the scattering-mode NSOM. Two SP waves, localized fields and propagating waves, generating in the near field were found by the transmission-mode NSOM, and the dependence of wavelengths was studied. The relations of scattering- and transmission-mode results were discussed as well. [C363]

"Reflectance Study of Nano-Scaled Textured Surfaces"

An algorithm based on rigorous coupled wave analysis is used to calculate the reflectance of two kinds of nano-scaled textured surfaces, periodic pyramid and random pillar structures. The device dimension and angular dependence are investigated. [C364]

"Trends and Future Directions in Nano Structure Based Computing and Fabrication"

As silicon CMOS devices are scaled down into the nanoscale regime, new challenges at both the device and system level are arising. While some of these challenges will be overcome in the near future, nanoscale devices will have high manufacturing defect rates and will operate at reduced noise margins, exposing computation to higher soft error rates. Thus, a key challenge for the future will be building fault and defect-tolerant computing systems. Researchers are looking to develop hybrid systems that combine on the same chip CMOS-based circuitry with any number of alternatives, including circuits composed of nanowire or carbon nanotube devices. The big advantage of including these new devices on the same chip is the increased device densities, and potential drop in fabrication costs. On the other hand, integrating very large numbers of devices on a single chip leads to questions of how to manage so many devices with tight constraints on cost, performance, power, and reliability, without having it become a design complexity nightmare. In this paper, we review some key issues and trends arising from nanostructure based computing and fabrication, while providing a few examples of defect-tolerant circuits and architectures currently being proposed as alternatives to "traditional" computing based exclusively on CMOS technology. These include hybrid nanowire/CMOS designs, reconfigurable or redundant architectures, and designs based on probabilistic computing. We end with a discussion on future challenges and direction in nanoscale computing. [C365]

"Simulation of light emission from a semiconductor nanowire/nanotube"

An optical modeling of light emission from a cylindrically layered semiconductor nanostructure is presented. The internal quantum efficiency and the assignment of total emission to lateral-surface emission and waveguide emission of a ZnO nanowire and a ZnO nanotube are studied and discussed. [C366]

"Inscription of a 300-nm-period nanostructure in a pure fused silica"

This paper reports on the fabrication of a first-order Bragg grating in Yb-doped fused silica fiber by inscribing a ~360-nm-period structure inside the fiber core. Its important application in the fiber laser area is also discussed. [C367]

"The design and fabrication of nanostructure on p-type GaN surface for GaN-based LEDs with high light extraction efficiency"

The parameters of nanostructure on p-GaN surface for light extraction efficiency of GaN based LEDs were studied by using Monte-Carlo ray tracing simulation, and nanostructures were fabricated by using interferential exposure and ICP dry etching. [C368]

"Modeling and Test of Nanostructure Fabricated on 160 nm Thin SOI Wafer for In-Ic Integration"

In this article we present a complete study of a mechanical nanostructure of the kind of accelerometer. Our models include in particular impact of submicron phenomena such Casimir force considering conductivity of silicon, thickness and roughness of the NEMS. We use these new results to simulate the static and dynamic behavior of on the nano accelerometer like specific design. We fabricated a NEMS demonstrator and performed first electrical measurements that we compared to our model. [C369]

"Label-Free, Microfluidic Separation of Human Breast Carcinoma and Epithelial Cells by Adhesion Difference"

A simple, label-free microfluidic separation of cancer cells by exploiting difference in cell adhesion. To maximize the adhesion difference, three types of polymeric nanostructures (50 nm pillars, 50 nm perpendicular and parallel lines with respect to the direction of flow) were fabricated using UV- assisted capillary moulding onto glass substrate of PDMS microfluidic channel. The adhesion force of human breast epithelial cells (MCF10A) and human breast carcinoma (MCF7) was measured independently by injecting each cell line into the microfluidic device followed by culture for a period of time (e.g., one, two, and three hours). Then, the cells bound to the floor of a microfluidic channel were detached by increasing the flow rate of medium in a stepwise fashion. The adhesion force of MCF10A was always higher than that of MCF cells regardless of culture time and surface nanotopography at all flow rates, resulting in a label-free separation of cancer cells. For the cell types used in our study, the optimum separation was found for 2 hours culture on 50 nm parallel line pattern followed by flow-induced detachment at a flow rate of 300 mul/min [C370]

"Low Power Laser Induced Microfluidic Mixing Through Localized Surface Plasmon"

We present a new optical microfluidic mixing approach via surface tension driven force sustained by the localized

surface plasmon (LSP) energy. The phonon energy associated with the non-radiative damping of LSP on an Au nanostructure creates thermal gradients capable of actuating a convective fluid flow. Experimental evidence and modeling results both show that LSP from the Au nanostructure is crucial to establish a temperature gradient with sufficient magnitude to induce the convective flow when using a low- power laser source. [C371]

"Optical Waves Transmission Raised by Localized Surface Plasmons"

A corrugated metal thin film can enhance the emission of light-emitting devices by the assistance of radiative surface plasmons. But, away from the resonant frequency, the metal thin film has a shielding effect on transmission. We replace the corrugated thin film by a discontinuous metal nanostructure, the isolated metal nanohemispheres can induce localized surface plasmons. The angular dependence and two different wavelengths are studied. The reflection on dielectric layers may be reduced and the transmission could be raised by the localized surface plasmons even the resonance condition is not fulfilled. The scattered Eycomponent is sensitive to the tilt angle, it might be useful to some novel applications. [C372]

"Do Quantum Dots or Quantum Wire Based Devices Offer a Practical Advantage in Producing Semiconductor Optical Amplifiers over Conventional 2-D Active Media"

Basic properties of nano-structure semiconductor gain media such as an inhomogeneously broadened gain, a fast response time, a low alpha-parameter and complex carrier dynamics yield amplifiers which are far superior to conventional quantum well amplifiers. [C373]

"Direct-Write micro/nano-structure for flexible electronic manufacturing"

This article focuses on optimizing the electrospinning parameters, and developing a new method of Direct-Write (DW) micro/nano-structure based on Near-Field Electrospinning (NFES) for flexible electronic manufacturing. NFES is a new way to realize controllable electrospinning and precision-positioning of nanofiber, by which nano-structure with diameter from 50 nm to 500 nm can be fabricated orderly and accurately. A tungsten electrode with tip diameter of 25 mum is used to DW nano-structure, with the minimum bias voltage 600 V, minimum electrode to collector distance 500 mum. A micro-structure DW system is designed, by which micro-structure with diameter of several micrometers can be drawn. In this work, a needle tube of 232 mum inside diameter is used as spinneret, electrode to collector distance is various from 2 mm to 10 mm, and the collector moving speed ranges from 0.07 m/s to 7 m/s. The DW process and character of micro-structure such as line width, smoothness and thickness can be controlled by optimizing the electrospinning parameters. The DW micro/nano-structure is continuous and smooth, which can be drawn on expected site and in expected direction with accurate dimension. The new method based on NEFS with the advantage of narrower line width and smoother structure than traditional flexible electronic manufacturing technologies, which is more suitable for the development of flexible electronic manufacturing. [C374]

"Synthesis of (AgIn)x Cd2(1-x) S2 Photocatalysts for H2 Evolution under Visible Light by Using a Low-temperature Hydrothermal Method"

We present a new visible-light driven photocatalyst (AgIn)xCd2(1-x)S2prepared by low-temperature hydrothermal method. Here, (AgIn)xCd2(1-x)S2with nanostructure shows photocatalytic activities for H2evolution from aqueous solutions containing sacrificial reagents, SO32-and S2-under visible-light irradiation even without any cocatalysts. The morphology and band gap of the photocatalysts are different with x changing from 0.01 to 0.5, and the band gap of (AgIn)xCd2(1-x)S2can be easily tuned from 2.32-2.08 eV. Importantly, the addition of Ag+and In3+ion to CdS can improve the light sensitization of photocatalyst. (AgIn)0.05Cd1.9S2with a 2.29 eV band gap has good photocatalytic activity for H2evolution under visible light irradiation even without a Pt cocatalyst (274.5 mumol g-1h-1), The photocatalytic activity (1172.3 mumol g-1h-1) of the same sample loaded with Pt cocatalyst is much higher than that of Pt-loaded CdS (40.2 mumol g-1h-1). [C375]

"Investigation of effects attributed to spherical carbon nanomaterials in proteomic matrix-assisted laser desorption ionization-time of flight mass spectrometer"

The study presents the mass spectrometric application of carbon nanomaterials in proteomic research. We utilized two spherical carbon nanomaterials, C60 buckyball and iron-cored carbonball (Fe-C), in peptide sequence identification of a serum protein using matrix-assisted laser desorption ionization-time of flight mass spectrometer (MALDI-TOF-MS). The biological samples used in the experiments were enzymatically trypsinized bovine serum albumins (BSA) peptides instead of synthesized small peptide fragments. Experimental results were compared and noticeable improvements in mass spectrometric spectrum were obtained and quantified. In addition, we also utilized EDS and TEM to determine the chemical composition and morphology of nanostructure

of iron-cored carbonball. [C376]

"Solid-state electrochemical stamping of functional metallic nanostructures"

A new approach of directly patterning metal at nano-scale with excellent dimensional resolution and flexibility is introduced for fabrication of functional nano-structures. This technique is based on the solid-state electrochemical dissolution of a metallic substrate at its contact with a pre-patterned surface of a solid electrolyte tool, and the subsequent formation of the complimentary pattern on the metal substrate as the solid electrolyte etches through the metal layer. Our results demonstrate repeatable and high-fidelity patterning of metal structures with a wide dimension range (20 mum to 50 nm). As this process is carried out in ambient environment and does not require wet chemicals, its potential for use as a simple and yet high-throughput metal patterning technique offers a highly competitive approach to fabricating functional structures and devices such as chemical sensors and photonic devices. [C377]

"The effects of edge defects on the switching characteristics of bit patterned media"

We present the results of micromagnetic studies on realistic patterning defects in perpendicularly oriented magnetic thin films. Both undercut and line edge roughness are investigated systematically with simulations using simple test structures to see the effect of the side wall angle, the roughness amplitude on a nanostructureiquests switching field, and the roughness period on mathematically tractable figures. We then run simulations of hysteresis loops of actual 200 nm diameter nanostructures using AFM images to define the structure boundary and compare the results to MFM images of DC demagnetized dots. [C378]

"Automatic design of reliable systems consisting of nano-elements"

The design of nano structures is considered a challenge for design methods, which have to cope with much more elements than traditional VLSI. Moreover, such elements will be unreliable due to unavoidable physical quantum effects. The inevitable fault tolerance leads to an additional increase of the design space. An extremely high number of nano-devices can be used for various redundancy schemes and many combinations thereof, thus promising an efficient solution to the reliability problem of nano devices. This paper proposes a heuristic design method based on a specific type of genetic algorithms. It has been adapted to the design of fault-tolerant nano systems with respect to the representation of systems as well as the fitness function and the underlying fault model. [C379]

"Compact SPR Gas Sensor for Mobile Robot Olfaction Using Metal Nanostructure and LED Light Source"

This paper reports on the development of compact surface plasmon resonance (SPR) sensors to be used for mobile robot olfaction. The proposed sensor uses a periodic metal structure formed on top of the self-assembled layer of polystyrene particles of 200 nm in diameter. With the grating of this size, SPR can be excited even with an LED light source. The change in the absorbance is simply measured using a photodiode. The experimental results are presented on a silver nanostructure sensor and a gold nanostructure sensor to show the potential of these sensors. [C380]

"Semiconductor Quantum Dot/Polymer Thin Film Based Hydrocarbon Sensor: Characterization of Sensing Properties"

Semiconductor CdSe quantum dots (QDs) have been surface functionalized with aromatic ligands for the sensitive and selective detection of hydrocarbons (HCs). By fabricating rough nanostructured films on silicon substrates using the QDs embedded in poly(methyl methacrylate) (PMMA), we have achieved so-far the lowest detection limit for HCs (e.g. ~15 ppm xylenes) within QD based sensing techniques. The introduced rough nanostructure of these films is thought to enhance the local electromagnetic field (EF), aiding in the observed high hydrocarbon (HC) sensitivity. Further, a detailed study of the sensing properties has revealed both QD photoluminescence (PL) enhancement and quenching processes, with the inversion point in the signal change occurring at increased HC levels, and being dependent on the QD surface ligand, QD loading, and polymer matrices. The following events appear to compete with each other, and determine the characteristic HC sensing behavior: 1) PL enhancement due to HCs adsorption on the QD surfaces or via pi-pi stacking interaction between the HCs and the QD surface groups, which dominates at low level HC exposures 2) Rough nanostructure registered local EF enhancement for enhanced photon absorption and emission from QDs, which diminishes with increased HC absorption in the film due to wetting effects at high level HC exposures, leading to significant PL quenching, and 3) Increased collection of background signal reflected from Si substrate under film wetting conditions, which may or may not be visible depending on QD loading and film thickness. [C381]

"Total light absorption in plasmonic nanostructures"

A simple physical model describing the optical properties of a metallic nanostructure in terms of the equivalent oscillating-current resonant circuit, which explains the total light absorption phenomenon in different plasmonic nanostructures on the same basis is presented. It was concluded that total light absorption results from matching the free-space impedance to the surface impedance of the nanostructure at the plasmon resonance. [C382]

"Color image processing with quantum dot structure on a multi-peak resonant tunneling diode"

Quantum dot nanostructure has dual advantages of high speed and small size. One promising new application for these devices is to use them for color image processing. However, the use of the quantum dot structure for image processing has been limited to black and white images. In fact, it is impossible to process general color images using the conventional quantum dot network. In this paper, we suggest a new quantum dot network design which implements color image processing. A novel quantum dot structure is formed by metallic islands on the surface of a multi-peak resonant tunneling diode. With the new structure and circuit configuration, we achieve filters for performing color quantization, smoothing, and color extraction. Based on simulation results, we achieve the new color image processor, which is 2 to 3 orders faster than conventional CMOS color image processors. [C383]

"In-situ TEM observation on nanostructure evolution during electrical stressing"

We evaluated the electrical properties and change of nanostructure of Cu doped SiO2and Ge2Sb2Te5(GST) thin film under electrical stressing. Specialized scanning tunneling microscopy (STM)-transmission electron microscope (TEM) holder, which allows us to do the electrical characterization and observation of in-situ nano-structural evolution simultaneously, used as a approach method to confirm the devices behavior. The Cu-SiO2/SiO2/Si structure observed that Cu nanoclusters, which are not fully crystallized, are randomly distributed. When voltage is applied, Cu becomes to grow and Cu cluster forms a closed packed line, which may a pathway for current flow. For GST/TiW/SiO2/Si structure, the GST film changed from amorphous phase to localized crystalline phase after electrical stressing. Localized crystallization might be due to the either joule heating or electron beam damages that are still need to be confirmed. [C384]

"High brightness field emission from carbon nanosheets and back-gated devices"

A 2D atomically thin nanostructure, carbon nanosheet, was synthesized via radio frequency plasma enhanced chemical vapor deposition. Carbon nanosheets are free-standing, and have flat surface morphologies, atomically thin edges, and defective graphitic structures. Field electron emission from carbon nanosheets was measured under diode mode. Carbon nanosheets samples have turn-on fields of 5-10 V/mum, and can yield a total emission current of 28 mA from an area of 8 times 8 mm2and an emission current density of ~2 mA/mm2from an area of 1 times 1 mm2. Back-gated triode devices using carbon nanosheets as cathode material were also designed, fabricated, and tested under triode mode. A total emission current of 1.3 mA was achieved from one single device. [C385]

"A Novel Method to Prepare Superhydrophobic, Self-Cleaning and Transparent Coatings for Biomedical Applications"

In this paper, a novel method of preparing nanostructured ultra-thin films for transparent superhydrophobic coatings is reported for the first time by Y. Xiu et al. A solgel process that uses a eutectic liquid solvent was employed. This solvent serves as both a low vapor pressure, low melting point liquid and a templating agent in the solgel process. UV-visible spectra indicate that after coating a glass microscope slide, with the transparent superhydrophobic coating, the light transmittance improved relative to that of a bare glass slide. The superhydrophobic surface is biocompatible because of the extremely low surface energy that results from the combination of a fluoroalkyl chain attached to the surface and the surface nanostructure. Preliminary studies suggest that the superhydrophobic coating may effectively prevent surface contamination by bacteria. [C386]

"Effect of Ion Depth in Low Energy Ion Scattering Spectroscopy for Evaluating Nanostructures"

In order to investigate the nanostructures, the spectroscopy technique providing the information on the top most layers or a few nanometer below the surface is required and the effect of ion depth in low energy ion scattering (LEIS) spectroscopy was investigated by Monte Carlo simulation. Helium ions with the energy of 0.1,1.0 and 10.0 keV were used as a probe ion in the simulation on the pure element target with atomic number from 3 to 92. The depths which ions can scattering out of the surface and the position just before the scattering of the surface were collected. These are used to indicate the region where the surface information can be gathered in the multiple scattering ions. For 1.0 keV ion, the typical depth for LEIS is only 10 nm from the surface, which is

suitable in characterization of nanostructures. The ion penetration depth was also evaluated by collecting the depth of terminated ion inside the target. This indicates the influence of ion into the nanostructure target at this thickness. [C387]

"Nanorobotic Manipulator Assisted Assembly of Complex Nanostructures based on Carbon Nanotubes"

In this paper, a series of in situ nanofabrication techniques of nanostructures, including cutting, bending and welding of carbon nanotubes (CNTs), inside a field emission scanning electron microscope (FE-SEM) is reported. In the CNT cutting technique, a CNT was exposed to a low energy beam assisted with 1 seem oxygen gas flow. The proposed technique is effective being capable of cutting a CNT in less than 1 minute. It was found that, although the total pressure of specimen chamber reached 10-2Pa, high speed cutting occurs only in the area close to the nozzle. The presence of oxygen gas in the vicinity of the CNT can be applied also for the bending of CNT, if some conditions of the cutting technique are changed. These include the increase of the acceleration voltage and/or setting the oxygen gas nozzle farther from the sample, and/or reducing the irradiation time. Using the proposed bending method the angles larger than 90deg can be formed and the location of the kink can be set accurately. It is also shown, that tungsten can be deposited on a substrate by the electron-beam-induced deposition (EBID), if the oxygen of the proposed cutting technique is replaced by W(CO)6. In this paper, these three nanofabrication methods were exploited in creation of a two dimensional (2D) nanostructure, the letters N and U, and a three dimensional (3D) nanostructure, the letter N. The 2D letters were constructed from 6 CNTs assembled on a substrate while the 3D letter N was bended from a single CNT and fixed to stand on a substrate. Based on the high performance of the proposed techniques, it is suggested that the cutting, bending, and welding techniques inside SEM will become widely utilized in the fabrication and assembly of nanodevices and in the characterization of nanomaterials. [C388]

"Modulation Spectroscopy Study of Inorganic-Organic Hybrid Quantum Well-like Nanostructures"

The optical transition energy in zinc selenide (ZnSe)/tris(8-hydroxyquinoline) aluminum (Alq3)/N,N'-Bis(3-methylphenyl)-N,N'-diphenylbenzidine inorganic-organic hybrid quantum well-like nanostructures (hybrid QW-like nanostructure) with well thickness of Aq3 from 10 to 50 nm were investigated by modulation spectroscopy as electroreflectance (ER) measurements. ER features due to optical transition energy were observed in the hybrid QW of well thickness. The transition energies were determined by fitting the ER spectra to the theoretical line-shape expression. The subband transition energy decreased with increasing well thickness might be due to the increase of well results in the reduction of quantum confinement energy. [C389]

"InP Ring-like Nanostructures on Ino.49Gao.51P Grown by Droplet Epitaxy"

The authors have successfully fabricated self-assembled InP ring-like nanostructures on lattice-matched In0.49 Ga0.51P on GaAs substrates by solid-source molecular-beam epitaxy using droplet epitaxy technique. The growth sequence is initiated by indium deposition which was intended to form indium droplets and followed by exposure P2beam to crystallize the indium droplets to InP. Dependence of the surface morphology on the indium thickness and substrate temperature was investigated. It is observed that the ring-shape nanostructure is formed when indium thickness is 1.6 ML and the ring shape and the ring-like quantum-dot molecule is formed when the indium thickness is thicker than 1.6 ML. The ring-like nanostructure is formed when indium deposition at 120degC and the ring shape and the ring-like quantum-dot molecule is formed when indium deposition at 150degC or higher. The density, height and number of dot per molecule of ring-shape nanostructure also depended on the indium thickness and on the substrate temperature while indium deposition. [C390]

"CMOS Nanostructure with Auto-Programmable Thermal Loop and Superior-Order Curvature Corrected Technique"

A new auto-programmable superior-order curvature-corrected integrated nanostructure will be presented, based on the compensation of the gate-source voltage temperature nonlinearity by a suitable biasing of a MOS transistor at a PTAT current. In order to maximize the temperature behavior of the system, a thermal stabilization circuit and an auto-programmable loop will be designed to select the optimal values for the chip temperature 7q and for the value of parameter a (equivalent to select the optimal type of the curvature-correction technique). Because these optimal values of a and 7q are determined using a previous stored data basis referring to the nanostructure circuit behavior, the errors caused by the finite precision of parameters determination will be cancel out. [C391]

"1D and 3D Shaped Ionic Liquid/Aluminum Hydroxide Nanohybrids for Electrochemical Device"

In this research, ionic liquids are considered as multifunctional components by employing not only templates and co-solvents for fabricating nanostructured materials but also proton conductors for electrochemical devices. Two ionic liquid-aluminum hydroxide nanohybrids obtaining 1D and 3D shape were synthesized via a one-pot ionothermal process. The shape-controlled nanohybrids are expected to be a strong candidate for electrochemical device in terms of reasonable ionic conductivity and thermal stability as a result of the one-pot assembled nano-confinements. [C392]

"Surface Profile and Optical Properties of Sb-doped SnO2 Thin Films"

Tin oxide (SnO2) and antimony-doped tin oxide (SnO2:Sb) thin films were deposited on the microscope slide glass substrates by sol-gel dip coating technique. Precursor solution was prepared using tin(IV) chloride pentahydrate, antimony chloride, urea, and hydrochloric acid. The Sb dopant concentration was varied from 1 to 4 mol% to investigate the effect of doping on the optical and surface roughness of the films. AFM image showed that undoped films having a very smooth surface morphology with nanostructure grain size in the range of 37.6 to 56.3 nm. Meanwhile, Sb-doped SnO2was more roughness if compared to undoped one. The optical properties of the films have been studied from transmission spectra in the ultraviolet-visible wavelength range. Energy gap of Sb-doped SnO2thin films are in the range of 4.07-4.11 eV, shifted to the lower value with increased doping concentration. [C393]

"Peeling and Cutting a Multi-Walled Carbon Nanotube inside a Scanning Electron Microscope"

Carbon nanotube (CNT) has many superior properties if compared to other materials which make it a promising nanostructure to be used in various nanoelectronic and mechanical systems (NEMS). The main problems involved in nanotube based applications are related to the fabrication process and especially to the machining and assembly of CNTs. In this paper, the techniques for peeling and cutting of multi-walled carbon nanotube (MWNT) are presented. Both the techniques take place inside the same observation devise a scanning electron microscope (SEM), which make the combination of the techniques effective. Also the size of the specimen chamber of a SEM enables the use of different fabrication methods like the assistance of a nanorobotic manipulator in different nanomanufacturing steps. The usability of the proposed techniques is verified in the manufacturing of a concept of one dimensional nanoactuator, which can be fabricated by the presented techniques. [C394]

"The Preparation of Self-formed PDMS Nanostructures by RIE Etching"

In this study, a novel fabrication method of nanostructure by reactive ion etching (RIE) process on PDMS without predefinition of nanopattern is proposed. During etching process, self-formed high-aspect-ratio nanostructure was observed on PDMS surface adjacent to SiO2area, suggested the provision of nano masks from the SiO2residue during RIE etching. In tuning the flow rate of working gases (CF4, O2), the distribution of nanostructure can be controlled. Furthermore, it was observed that different species of nanostructures could be fabricated by the selection of mask materials (SiO2, Cu) under RIE etching. [C395]

"Nanoscale Dot Patterning by Anodic Oxidation with Atomic Force Microscope"

We report on nanoscale patterning by anodic oxidation in ambient using the atomic force microscope (AFM). Dot patterning on silicon and indium tin oxide (ITO) surfaces was achieved by applying a voltage pulse to induce surface oxidation. Oxide protrusions with size less than 100 nm have been created. The width of these oxide dots was found to vary slightly with the duration of the voltage pulse for both types of substrates. Meanwhile, the height of the dots exhibited a greater variation, particularly in the case of ITO, which may be linked to the surface roughness and the local material composition. A total patterning area of up to 100 times 100 mum2is achievable by programmed movements of the AFM tip. Such patterning, in combination with other processes such as metal deposition and etching, should prove a powerful tool for future applications in nanostructure fabrication and nanoscale electronics. [C396]

"High Efficiency Quantum Dot Molecule Solar Cells for High Concentration Sunlight Application"

InAs quantum dot molecule (QDM) solar cells are fabricated by modified molecular beam epitaxy technique. With multi-stacks and high dot density greater than 1012cm-2, a QDM solar cell with hetero-structure provides high conversion efficiency of 25.9 % under 100 mW/cm2AMI solar simulator. The improved efficiency of this novel nanostructure solar cell is due to the extension of solar response to long wavelength region beyond the band edge of GaAs, which is used as the substrate for the hetero-structure of AlGaAs/GaAs having InAs quantum dot molecules as the active part of the solar cells. It is also found that QDM solar cells perform better at high concentration sunlight due to the low dimensionality of quantum dot structure. [C397]

"Magnetoresonance Research of Cox(Al2O3)1-x Nanogranular Films in the Vicinity of Magnetic Phase Transition"

The ESR response of 35-40 GHz band from nanostructure Cox(Al2O3)1-xwas analyzed. The linewidth increases while the Co concentration decreases. The magnetization of saturation drops to zero when Co concentration decreases up to concentration of Co falls up to metal-dielectric threshold. The magnetic phase transition from ferromagnetic to superparamagnetic state has been detected in the vicinity of the metal-dielectric transition. [C398]

"Efficient Electrical Electron Spin Injection from Ferromagnetic Metals in Nanostructures"

A spin-polarized electron transport in a double-barrier tunneling nanostructure which contains CoFe/MgO spin injector has been investigated. The electron spin polarization ratio was calculated in the framework of the two-band model of free electrons in ferromagnetic metal contact. The influence of the bias voltage and tunnel barrier height on the spin polarization ratio of the electron current as well as the optimal bias voltage and the nanostructure parameters, which ensures the efficient electrical electron spin injection into nanostructures, were also determined. [C399]

"A Study on Band Nonparabolicity Effects in Nanostructures"

In this work we develop a simple method to study the effects of the nonparabolicity of the bands on the carrier states for a general nanostructure under a constant electrostatic potential. In these conditions we show the way to exactly include the nonparabolic corrections after solving the parabolic Schrodinger equation for a given nanostructure. [C400]

"Solid Phase Direct Write (SPDW) of Carbon Via Scanning Force Microscopy"

The fabrication of carbon nanostructures by direct writing with a scanning force microscope is described. A conductive atomic force tip is used to collect carbon from a glassy carbon substrate and then redeposit it onto a gold thin film under voltage control. The resulting patterns are examined using the same atomic force microscope and analyzed using x-ray microprobe elemental analysis. These carbon patterns can act as etch masks or integral components of a nanostructure or device. Evidence is presented that the primary mechanism responsible for the carbon deposition is electromigration from the carbon coated atomic force microscope tip. Writing of carbon with linewidths as small as 40 nm is demonstrated. [C401]

"Mechanism of Nanostructure Carrier on Improvement of Catalytic Sensor's Sensitivity"

The stability of sensitivity of catalytic sensor was greatly improved by method of carbothermic. The sensor had nanobelts structure, moderate aperture and appropriate distributing of granularity after the process of carbothermic technique. The nanobelts structure of the sensor had even and stable distributing of catalyst on carrier, and the density and intensity of the carrier were higher and the ability of anti-sintering was greater than common sensor, so it would effectively prevent the attenuation of sensitivity of catalytic sensor in long-term working. The result of experiment showed that the sensitivity of catalytic sensor prepared by nanobelts attenuated only 7% in 30-day which was much better than 11% of common sensor. [C402]

"Near Field Microscopy for Nanostructure Quality Characterization in Millimeter Wave Range"

Millimetre waves near-field microscopy are described. Examples of radio images (amplitude and phase pictures) optically opaque subjects with use of methods of near-field microscopy and also results of investigations of spatial inhomogeneity of properties in multilayered thin-film nanostructures with effect of giant magnetic impedance are resulted in the field of frequencies 35-80GammaGammamu. [C403]

"Fabrication and Characterization of Nanostructured Ta-Si-N Films"

In this paper, the morphology and properties of nanostructured Ta-Si-N thin films fabricated by reactively cosputtering have been studied. The Ta-Si-N film is a mixed composite consisting of the Ta-Si, Ta-N and Si-N compounds. The TaN phase is polycrystalline while SiNx is amorphous. As Si is added to the Ta-N compound to form Ta-Si-N, the micro structure becomes nanocrystalline grains embedded in an amorphous matrix i.e. amorphous-like micro structure, which is also affected by the nitrogen flow ratio i.e. FN2%= FN2/(FN2+FAr) times 100% during sputtering. Amorphous-like Ta-Si-N films obtained at small FN2% of 2-10% had smaller roughness, lower resistivity and larger nanohardness compared to polycrystalline films at high FN2% of 20- 30%. The variation of Ta-Si-N micro structure leads to the different electrical and mechanical properties of films. The electric resistivity of Ta-Si-N increases with increasing FN2% while the nanohardness first increases to a

maximum of 15.19 GPa from FN2% of 2% to 3%, then decreases with increasing FN2%. The higher hardness in amorphous-like Ta-Si-N exhibits a larger stiffness and resilience than polycrystalline one. [C404]

"A Theoretical Model for Laser Assisted Direct Imprinting (LADI)"

This paper presents a comprehensive theoretical modeling for the laser assisted direct imprinting (LADI) process, which utilizes a quartz mold, pulsed laser heating, and contact pressure for direct nano-patterning and nanostructure fabrication on silicon substrates. The purpose of this work is to reveal the underlying mechanism behind LADI and to quantitatively characterize important imprinting parameters which dominate a successful LADI process. The theoretical modeling consists of three elements, the time-history of silicon melting when subjected to pulsed laser heating, the elastodynamic movement of mold's surface under resistance pressure, and the squeezing out of the molten silicon layer under the pressure from the walls. We have accurately determined the governing equations for each physical problem and derive the interaction relationship between them. A numerical scheme is developed to modeling the whole LADI process. The role of each important factor such as laser fluence, contact pressure, viscosity of molten substance and mold's feature size can be understood and visualized through this model and their influences on the final imprinting depth are also quantitatively determined. [C405]

"Nanoscale Cutting, Bending and Welding in a Nanoassembly"

Carbon nanotube (CNT) can be used as a building block of nanoelectronic mechanical systems (NEMS). The main problems involved in nanotube based applications are related to the fabrication and assembly of the CNT. In this paper, in situ nanofabrication methods, involving cutting, bending, and welding of multi-walled carbon nanotube (MWNT) inside a scanning electron microscope (SEM), are presented. These three nanofabrication techniques are further used in the assembly of a CNT based nanostructure. A three dimensional (3D) nanostructure, the letter N, was assembled from a single CNT and fixed to stand on a substrate. Based on the high performance of the proposed techniques, it is suggested that the cutting, bending, and welding techniques inside SEM will become widely utilized in the fabrication and assembly of nanodevices and in the characterization of nanomaterials. [C406]

"Cellular Nonlinear Network with Spin Wave Bus"

We propose and analyze a cellular nonlinear network based on semiconductor nano-structure consisting of multiple layers of two semiconductors along with an incorporated ferromagnetic layer-spin wave bus. A bi-stable elementary logic cell of the proposed CNN consisting of two resonant tunneling diodes inductively coupled with the ferromagnetic layer. The local interconnections of nano-cells are achieved via the spin waves propagating in the spin wave bus. The cells are biased by the common column contacts and only the edge cells have individual I/O ports. Using approximate tunneling characteristics and experimentally obtained data for spin wave propagation in CoFe thin film, we simulated the coupling between an individual cell and spin wave bus. The proposed CNN architecture for nano-structures possesses powerful computing potential to be beneficial for many practical applications [C407]

"InP/InAs core-multishell heterostructure nanowires grown by metalorganic vapor phase epitaxy"

We report the growth and characteristics of InP nanowires and InP/InAs/InP core-multishell nanowire arrays by selective area metalorganic vapor phase epitaxy. InP hexagonal nanowires with (110) sidewall facets were successfully formed on (111)B InP substrates. The core-multishell nanowires were also formed composed of InAs tube-like layer buried in a higher bandgap InP nanowire. The precise control over nanowire growth direction and heterojunction formation enabled the successful fabrication of the nanostructure in which all the three layers were epitaxially grown without the assistance of any catalyst. The periodically aligned nanowires and core-multishell nanowires were highly uniform, and Wulzaite structures. 4 K photoluminescence measurements confirmed the formation of strained InAs quantum well on InP (110) sidewalls and the well widths corresponding to the PL peaks were in good agreement with calculated values. [C408]

"Special Invited Lectures: Microfabrication and Nanostructure Processing of Advanced Biological Systems"

Microelectromechanical systems (MEMS) can be combined with nanostructured materials in the design of multifunctional devices. MEMS provide for the ease of microfluidics control, and allows for the full integration of mechanical and electrical components at the macroscopic level through a top-down approach. In contrast, nanostructured materials enable the bottom-up synthesis and assembly of molecular, supramolecular and nanometer-scale structures with controlled surface functionalization. By bringing together MEMS and nanostructured materials, we can achieve (i) automated preparation and manipulation of biological samples, (ii)

high-throughput drug screening, (iii) ultrasensitive biomolecular sensors and medical diagnostics, (iv) complex bioreactors for cell and tissue engineering, and (v) biomimetic artificial organs and implants. This presentation describes the exciting possibilities of engineering advanced biological systems by combining microfabrication of devices and nanostructure processing of materials. [C409]

"Coherent exciton-surface plasmon polariton interactions in hybrid metal semiconductor nanostructures"

We report an experimental study of the coherent coupling between Surface Plasmon Polaritons (SPPs) and Quantum Well (QW) excitons in a hybrid metal- semiconductor nanostructure, consisting of a gallium arsenide quantum well placed in a close proximity of a metal nanoslit array. Exciton-SPP coupling is probed by low-temperature angle resolved spectroscopy. Our results give evidence of a distinct modification of the exciton dispersion relation due to interaction of the exciton with SPP fields at both interfaces of the metal film. An analysis of the experimental data within a coupled oscillator model indicates coupling strengths of several tens of meV. [C410]

"Finite element analysis of heat transfer in nanowires (NWs)"

Energy transport in nanostructures differs significantly from macrostructures because of classical and quantum size effects on energy carriers. Thermal conductivity of nanostructures is significantly lower than that of their bulk constituent materials. Based on the concept of thermal conductivity, a simulation study is used to demonstrate the nature of heat transfer in Si nanowires (NWs) in this paper. [C411]

"Mechanical reliability of micro/nano-structures in MEMS devices"

In this paper,the mechanical reliability evaluation for micro/nano-structure in MEMS devices is analyzed to establish theories of MEMS materials, especially of silicon.In order to evaluate the mechanical strength of micro/nano-structure in the same dimensions as the actual devices, we have developed a tensile testing method and testing tools dedicated for micron-sized specimens.We have evaluated the size effect and process dependence on the tensile strength of polycrystalline silicon, environmental effect on strength of silicon, SiO2, and SiN films, and high temperature fracture behavior of single crystal silicon. The displacement-stress curves of single crystal silicon tensile-tested at 600degC, which indicates the yield points at the middle of curves. The fractured specimen, which indicates slips on (111) plane is occurred near the fracture surface. [C412]

"Field emission properties of carbon nanostructures: A review"

Carbon nanotubes (CNTs), carbon nanoflakes (CNFs), carbon nanoparticles (CNPs) and other related structures (known as carbon nanostructures (CNSs)) have emerged as a promising class of materials as field electron emitters. They have a low threshold field and a high emission current density which make them attractive for technological applications. In this article, we review recent progress on understanding of CNS field emitters and discuss issues related to applications of CNS based cold cathodes in vacuum microelectronic devices. The emphasis is on the emission characteristics of macroscopic CNS cathodes and their relations with the underlying materials properties. In addition, some of realistic applications based on CNTs field emission have also been discussed. [C413]

"Increasing the thermoelectric figure of merit for bismuth and bismuth-antimony"

Bismuth and bismuth-antimony alloys have proved to be excellent low-temperature thermoelectric materials but their small or negative energy gap has not allowed their use in Peltier or Seebeck devices at ordinary temperatures. Other authors have shown that the energy gap may become large enough for practical purposes if the materials are prepared in low-dimensional form. However, we have demonstrated that the Seebeck coefficient of such materials can be substantially increased by the introduction of ionised-impurity scattering and that this may lead to a dimensionless figure of merit, zT, approaching unity, even if the lattice thermal conductivity is as high as it is in pure bismuth. Our calculations make use of a simple model in which the reciprocals of the relaxation times for lattice and impurity scattering of the charge carriers are supposed to be additive. Furthermore, if the lattice conductivity can be reduced to a value well below that for bulk bismuth, then zT in excess of unity should be obtained. It is possible that this may be achieved for nanostructured samples in which the dimensions are not yet small enough for the band structure to be modified. However, if a positive energy gap can be reached through the formation of a nanostructure this is even better. We conclude that, in some form or other, bismuth and bismuth-antimony must be regarded as most promising materials for nanostructure studies. [C414]

"Synthesis and characterization of ZnO nanostructures"

Nanostructures of zinc oxide are synthesized by physical vapor condensation method. From the SEM image, it is observed that these nano structures look like nanosprings mixed with nanorods. The typical diameter of these nanostructures is in the range of 80-150 nm and the length is of the order of several micrometers. The XRD data shows a sharp peak at 36.87deg which is very close to that of zinc oxide nanorods grown by oxidation in the presence of ambient gases i.e. oxygen mixed with argon. UV visible spectra of these nanostructures shows a peak at 371 nm and 373 nm. The broad peak at 373 nm is responsible for the conversion of zinc into zinc oxide. [C415]

"Free carrier absorption in free standing quantum well nanostructures"

A calculation of free carrier absorption in a free-standing quantum well (FSQW) nanostructure due to the electron interaction with confined acoustic modes described by elastic continuum model is presented. Numerical results are given for GaAs FSQW structure for the dependence of absorption coefficient on photon frequency electron temperature and thickness of the nanostructure. The oscillatory dependence of absorption coefficient on thickness of the FSQW nanostructure is attributed to the energy dispersion of confined acoustic modes which is in contrast with the calculations based on bulk description of acoustic phonons. [C416]

"Eduction's Position Control of the Incorporated Gallium in the Diamond-like Carbon Deposited by Focused-Ion-Beam Chemical-Vapor-Deposition"

Summary form only given. Deposited materials by focused-ion-beam chemical-vapor-deposition (FIB-CVD) have a lot interesting material characteristics. It contains the gallium (Ga) because Ga is implanted by Ga+FIB irradiation. Atomic ratios of the diamond-like carbon (DLC) deposited by using phenanthrene (C14H10) as a gas source for FIB-CVD is C: Ga = 95: 5. And, it is noted that the incorporated Ga in DLC is segregated again from DLC by annealing treatment. By annealing treatments at approximately 400 degree C, the segregated Ga is appeared on the DLC surface in form of the sphere. However, Ga sphere is appeared on the random position of DLC surface. There have not yet been any reports concerning the method for the eduction's position control of Ga contained in DLC deposited by FIB-CVD. So, the several experiments were carried out to examine the eduction process of incorporated Ga from the nanostructure made of DLC. As a result, we found that the eduction's position control of Ga sphere could be achieved by via hole fabricated on the nanostructure using FIB-etching. In this experiment, DLC pillar was fabricated by a spot irradiation of 30 kV Ga+FIB with a beam current of 8 pA. And a via hole was fabricated on the tip of DLC pillar by FIB-etching. Ga sphere was obtained on the tip of DLC pillar by 15 min annealing treatment at 350 C. Atomic ratio of Ga sphere formed by annealing treatment was C: Ga = 2.4: 97.6. Furthermore, DLC wall structure was fabricated by FIB-CVD, and three via holes were fabricated by FIB-etching. By annealing this structure, we obtained Ga sphere on the top of DLC wall structure. In this way, we found that the Ga sphere was formed on the via hole inevitably. From these results, the Ga eduction mechanism is presume as follows; the incorporated Ga moves toward the via hole, Ga is accumulated in the via hole, Ga sphere is formed finally because Ga has the large value of the surface tension (720-mN/m). In this way, we achieved the eduction's position control of the incorporated gallium using the via hole. This technique is the utilizable technique as a junction technique such as a nano-bump technique to combine the nanoelectromechanical devices. [C417]

"TEM characterization of microstructure and composition of nanostructures formed by electron beam induced deposition with tetrakis(trifluorophoshite)-metal precursors"

In this paper, nanowires were fabricated by electron beam induced deposition using tetrakis(trifluorophosphite)-metal precursors. The microstructure and composition of the nanostructure were characterized by transmission electron microscopy (TEM). [C418]

"System Design in Removal of ITO Thin-Film Nanostructure From TFT-LCD Color Filters"

This research presents a new design modus using electrochemical machining as a precision recycling process of ITO thin-film removal from optoelectronic flat panel displays color filter surface. An effective and low-cost recycling process is developed. [C419]

"Development of focused-ion-beam (FIB) machining systems for fabricating 3-D micro- and nano-structures"

This study has developed a three-dimensional (3D) focused-ion-beam (FIB) etching system and a method for machining 3D sensor structures. The FIB etching equipment enables precision cuts to be made with great flexibility for micro- and nano-structure on thin films and single crystals. Hence, the FIB etching system offers a

variety of new applications in the area of imaging and precision micro-machining. [C420]

"Novel fabrication of micro-nano mixed 3D-structure by advanced hybrid nanoimprint lithography"

To fabricate micro-nano mixed 3-D structures, the novel mold fabrication containing micro-nano patterns in both lateral and vertical directions is difficult because there are no suitable lithography methods having deep focus depth in nanopatterning. In the hybrid NIL approach, the nanostructure could be fabricated only on the top surface of microstructures. In this paper, a newly advanced hybrid patterning by thermal and UV NIL to fabricate micro-nano mixed structures is proposed not only on the top surface of the microstructure but also on the bottom of the microstructure without using deep dry etching or mixed and match lithography. [C421]

"Tuning of Wetting Behavior on Patterned ZnO Coatings by Nanoimprinting"

In this study, nanoimprinting on ZnO sol-gel film is used to prepare regular nanostructure for tuning the wetting properties of the coatings, which is a very simple and relatively inexpensive method to produce high quality patterned film. However, the hydrophobicity of the surfaces comes from its rib patterns, and the surface roughness not only contributes to the very large fraction of air trapped on the surface but also interrupt the three-phase contact line of water droplet on the surface. [C422]

"The complex mechanisms of Ion Beam Induced Deposition"

In this paper, Ion Beam Induced Deposition (IBID) mechanisms for nanostructure growth are investigated in terms of the contribution of secondary atoms, secondary electrons, and primary ions. [C423]

"Field-emission properties of 3D ZnO network structure synthesized with solvent thermal method"

Different shapes of ZnO nanostructure may lead to different field emission properties. In this paper we first synthesized zinc oxide nanorod via a solvent hydrothermal method. The reactants are zinc nitrate hex hydrate and sodium hydroxide, organic alkali is hexamethylenetetramine (HMT, (CH2)6N4) and the solvent is absolute alcohol (Lie and Zeng, 2003). With the concentration ratio of [Zn2+]:[OH-] changed from 1:100 to 1:10, some different structures of ZnO which include nanoflake, nano flower, and nanowire have been synthesized. With the lower ratio of sodium hydroxide, the more nanowire shape ZnO exists. The nanowires tangle together and form three-dimensional network structure which has a large surface area and benefits for field emission. [C424]

"Enhanced field emission properties from ZnO nanostructure by improving contact behavior"

In this paper, we have studied the contact effect on the field emission properties of ZnO nanostructure printed on various substrates to understand emission performance more exactly. Here we demonstrated the field emission properties from the tetrapodlike ZnO nanostructure screen printed on Ag, carbon nano fiber (CNF)/Ag substrate respectively. The ZnO nanostructure is produced by chemical vapor deposition. Field emission properties were measured using a diode structure configuration, and the contact behavior between ZnO emitter and these substrates were also observed by scanning electron microscopy (SEM). [C425]

"Efficiency of surface conduction electron emission from ZnO nanostructure"

In this paper, we study the influence of the ZnO nanostructures, gap between cathode and gate, resistance of ZnO layer, and the accelerate electric field on the ration of Ia/Ig. Fig.3 gives the variation of gate current and anode current with different cathode-gate distance. From these curves, the electron emission efficiency can be estimated. [C426]

"Resistance effects on field emission for one-dimensional nanostructure grown on silicon substrate: A simulation study using classical transport model"

This paper studies the resistance effects on field emission for one-dimensional nanostructure grown on silicon substrate. In this study, the carrier transport model developed in our previous works (Lan et al., 2005) is applied to investigate the resistance effects of the CNT (carbon nanotube) grown on doped silicon substrate. [C427]

"High resolution AFM Moirй technique for the detection of defects in nano structure"

Moire interferometry is a useful technique to assess the reliability of electronic package because Moire interferometry can measure the whole-field and real-time deformations. The optical limitation of Moire interferometry makes ambiguous the shear strain of a micro area. An atomic force microscope (AFM) is used to measure the profile of a micro site. High resolution of AFM can apply to the Moire technique. AFM Moire

technique is useful to measure the strain of a small area. Also, AFM Moire technique is used to detect of defects in nano structure. In this research, the method to accurately measure the deformation of a small area by using AFM Moire is proposed. A phase-shifting method is applied to improve the resolution of AFM Moire. [C428]

"Middle-infrared ultrafast superconducting single photon detector"

We present the results of the research on quantum efficiency of the ultrathin-film superconducting single-photon detectors (SSPD) in the wavelength rage from 1 mum to 5.7 mum. Reduction of operation temperature to 1.6 K allowed us to measure quantum efficiency of ~1 % at 5.7 mum wavelength with the SSPD made from 4-nm-thick NbN film. In a pursuit of further performance improvement we endeavored SSPD fabricating from 4-nm-thick MoRe film as an alternative material. The MoRe film exhibited transition temperature of 7.7K, critical current density at 4.2 K temperature was 1.1times106A/cm2, and diffusivity 1.73 cmVs. The single-photon response was observed with MoRe SSPD at 1.3 mum wavelength with quantum efficiency estimated to be 0.04%. [C429]

"High Frequency Carbon Nanostructures that Smell, Weight, Harvest and Handle"

In this paper we present the state-of-the art of high frequency carbon nanostructure devices dedicated to sense, harvest and handle. However, we do not restrain our analysis only to high frequency applications, but provide a general overview of carbon nanostructures that sense various parameters, harvest or handle electric or electromagnetic energy, all these properties conferring them the status of smart materials. Numerous applications based on these smart materials are envisaged, but some of them are especially scrutinized in this paper, e.g. biological applications, wireless applications, and energy harvesting and generation. [C430]

"Power generation characteristics of oxide thermoelectric modules incorporating nanostructured ZnO sintered materials"

A practical oxide thermoelectric module consisting of 12 pairs of p-NaCo2O4and nanostructured n-ZnO sintered materials was successfully fabricated by using a diffusion welding technique. By applying a nanostructure using a void forming agency (VFA), the electrical conductivity of the n-ZnO sintered materials were drastically enhanced, leading that the power factor of the materials were dramatically improved. It is revealed that the oxide module can be operated up to 930 K on the hot side temperature. A maximum power output of 52.5 mW was achieved at the temperature condition of TH/TL=934/479 K, where THand TLare temperatures at the hot and cold sides of the module, respectively. The details of the power generation characteristics of the present oxide module will be presented and the performance will be discussed with those of our previous and other oxide modules. [C431]

"The preparation and thermal transport property of nanostructured Yb-filled CoSb3 induced by melt spinning technique"

The Yb-filled YbxCo4Sb12(times=0.2-0.5) bulk materials with special nanostructure were prepared by combining melt spinning method with spark plasma sintering (SPS). The microstructure and thermal transport property of YbxCo4Sb12were investigated. The microstructure observations were performed by using high-resolution transmission electron microscopy and field emitted scanning electron microscopy (HRTEM and FESEM). The results show that ribbon-shaped samples after melt spinning are composed of nanocrystals and amorphous-like phases, and possess preferable crystal granularity and evengranular distribution with roller linear speed of 30 m/s and nozzle pressure of 0.02 MPa; the bulk materials after SPS are composed of minicrystals with 200 nm average diameter which is formed by nanocrystals with 5-20 nm diameter. This special microstructure increases grain boundary scattering notably, and has great effect on phonon behavior. As a result, the thermal conductivity of the material is decreased remarkably. Compared with the sample prepared by melting-quench-diffusion annealing method with the same filling fraction (times=0.5), thermal conductivity of the sample prepared by melt spinning method decreased 50% from 4.0 Wm-1K-1to 2.0 Wm-1K-1at 600 K, and the sample still possesses relatively high power factor. [C432]

"Nanostructural characterization of TiNiSn-based half-Heusler compounds"

We performed nanostructural characterization of TiNiSn-based half-Heusler materials with respect to materials processing and YSb doping. The samples were prepared using radio frequency melting, followed by the liquid quench (LQ) process. It is found that the LQ process employing a BN nozzle enhances the compositional homogeneity and reduces impurities, such as Si and O. Correspondingly, the power factor of (Ti0.5Zr0.25Hf0.25)NiSn alloys is significantly improved over those fabricated using a silica nozzle and without the LQ process. The nanostructure of the YSb-doped samples is investigated with a laser-assisted local-electrode atom-probe tomography. The results demonstrate homogeneous distributions of Ti, Zr, Hf, Ni, and Sn

over the analyzed volume of material, while a one-dimensional chain-like feature of Y are observed with increasing the Y doping concentration, which is the key for controlling the nanostructure for improvement of the thermoelectric properties in these multi-component systems. [C433]

"Thermoelectric characteristics of solvothermally prepared (Bi,Sb)2 Te3 mats containing nanosize of sheet-tubes"

We report thermoelectric characterization of Bi2-xSbxTe3(x = 0.5, 1.0, and 1.5) synthesized by a solvothermal method using DMF as solvent. For Bi2Te3, the size of the edge and thickness of the hexagonal nanoplatelets are 200-250 nm and 20-25 nm, respectively. Bi2Te3nanosheets appear to grow epitaxially from the surface of the Te tubes, which forms in the first step and acts as the template for the formation of the nanostructure. Upon doping with Sb, the morphology of Bi1.5Sb0.5Te3changes to a cluster of nanoparticles with the size of ~100 nm. The morphology of Bi0.5Sb1.5Te3consists of mainly nanoplatelets with a size of less than 100 nm and warped nanosheets growing along the Te tube. The nominal composition of Bi2Te3mats containing sheet-tubes shows a negative thermopower of ca. -94 muV/K at 280 K, whereas Bi0.5Sb1.5Te3shows a positive thermopower of ca. 200 muV/K at 280 K. [C434]

"Fabrication of field-emission cathode ray tube with an unique nano-structure carbon electron emitter"

In this study, a field-emission cathode ray tube (FE-CRT) has been fabricated using novel kind of electron emitter called carbon nano-exit (CNX) which has been developed on nickel, silicon and SUS substrate with a special plasma chemical vapor deposition (CVD) technique. Scanning electron microscopy(SEM) image indicates that the emitters have an array density of 2times108/cm2. [C435]

"Nanostructure sensor films preparation by extraction-pyrolysis technique"

We propose the extraction-pyrolysis technique for deposition of nanostructure films of oxide functional materials. The carboxylic acids have been used as extragent. The extraction process was realized by cation exchange mechanism. At the selective extraction the anions of inorganic salts and impurities of cations was not extracted in organic phase. Therefore, the application of extraction allows obtaining pure materials. In order to adjusting of metals concentration the extracts undergoes to analysis by atomic absorption spectroscopy. To determination the decomposition temperature TG-LTA investigations have been carried out. It was found that thermal decomposition of metal-carboxylates take place at 400-450 degC. [C436]

"Nanostructure and thermoelectric properties of p-type Bi0.5 Sb1.5 Te3 compound prepared by melt spinning technique"

P-type Bi0.5Sb1.5Te3bulk material with fine nanostructure has been prepared by combining melt spinning technique with spark plasma sintering (SPS), and the effects of microstructure on the thermoelectric transport properties are investigated. Bi0.5Sb1.5Te3ribbons with fine nanostructure are obtained during the melt spinning process and the grain sizes of Bi0.5Sb1.5Te3are about 5-15 nm observed by High-resolution transmission electron microscopy. Such structure has great influence on thermoelectric transport properties of Bi0.5Sb1.5Te3compound. Compared with zone melting and directing SPS samples, the lattice thermal conductivity of the sample processed by melt spinning decreases significantly due to the intensive phonon scattering induced by the fine nanostructure. The greatest thermoelectric figure of merit (ZT) of 1.20 is obtained at 300K for the sample which is prepared by melt spinning with roller linear speed of 10 m/s. [C437]

"Silicon Nanowires as Non-Cytotoxic Scaffold for Fibroblast Development"

This study aims to develop an in vitro cell culture system integrated with silicon nanowire scaffold to study fibroblast development and evaluate the biocompatibility of nanostructure. A bottom up strategy is utilized to synthesize the silicon nanowires on diced silicon chips. Scanning electron microscopy is used to characterize the nanowires. Results show that the nanowires induce extraordinary influence on cell aggregation and possess potential in tissue engineering. [C438]

"CMOS Integrated Circuit with Improved Temperature Behavior Based on a Temperature Optimized Auto-Programmable Loop"

A new auto-programmable superior-order curvature-corrected integrated nanostructure will be presented, based on the compensation of the gate-source voltage temperature nonlinearity by a suitable biasing of a MOS transistor at a PTATalphacurrent. In order to maximize the temperature behavior of the system, a thermal

stabilization circuit and an auto-programmable loop will be designed to select the optimal values for the chip temperature T0and for the value of parameter alpha (equivalent to select the optimal type of the curvature-correction technique). Because these optimal values of alpha and T0are determined using a previous stored data basis referring to the nanostructure circuit behavior, the errors caused by the finite precision of parameters determination will be cancel out. [C439]

"Nanostructure Induced Surface Plasma Resonance of Broadband Organic Emitting Materials"

We demonstrate the photoluminescence (PL) characteristics of a two-layer organic emitter on the corrugated structure of nano-meter scale. A strong emission was observed on certain viewing angles which come from the surface plasma resonance. Different organic materials provide a broadband radiation which improves the PL intensity. [C440]

"Single semiconducting zinc oxide nanowire based device for thermal and airflow sensing"

This paper reports a technology for fabricating a novel nanostructure-based device comprised of a single semiconducting zinc oxide (ZnO) nanowire suspended between two micro Au electrodes for sensor applications. The electric characteristics of the device before and after processed by Pt deposition using focused ion beam microscope were comparatively studied. Furthermore, the potential applications by using the device for thermal and airflow sensing were also investigated. The temperature coefficient of resistance of the ZnO nanowire was estimated to be about -2.61 times 10-3degC-1. The airflow sensitivity of the device is about 3 kOmega/m/s. Compared with conventional sensors, this device takes advantages of high sensitivity and ultra-low power. [C441]

"Rewritable grating made of metamaterial with nanostructure"

A metamaterial was fabricated by capsulating photochromic solution in nanoholes of polycarbonate. Nanoholes not only provided sufficient free volume for dye molecules to change structure for coloration, but also prevented the solution to flow and disturb an optically-induced grating pattern. The material exhibited a blue color by ultraviolet irradiation, and returned to the original transparent state when photobleached with visible light. A grating pattern was written in the material by irradiating an interference fringe of green laser. This grating pattern could be erased by ultraviolet irradiation, and a grating with a different period could be written in the same film. [C442]

"Nano patterned titanium for orthopedic applications"

The structure of implant surfaces plays an important role in the interaction between the implant and its surroundings because it is in direct contact with living tissue1. Since tissues are known to have nanostructures, the development of implants with surfaces that mimic this type of structure is a crucial factor in allowing the tissue to recognize the implant and therefore exhibit better adhesion properties. This study involves examining osteoblast function on nano patterned titanium substrates created using electron beam evaporation. These patterns appear to better promote bone cell functions more similar to long bones of the body. As a result of mimicking the structure and properties of bone, initial formation of anisotropic bone upon implantation will occur. [C443]

"Electrochemical polyaniline/polypyrrole composite film with novel nanostructure and high biosensitivity"

Conductive polymer, such as polypyrrole (PPY) and polyaniline (PANI), have shown a special ability to rapidly and reversibly switch between different oxidation states [1,2], which plays a critical role in biocommunication. In addition, various biomolecules can be incorporated into conducting polymer by electrochemical polymerization. These two abilities make conducting polymers potential candidates for application in the area of biosensors [3,4]. The synthesis of conducting polymer films thus has recently been an increasingly important subject of intensive research. [5,6] PPY is the most thoroughly investigated one among various conducting polymers for biological applications because of its high electrical conductivity in wide range of pH values, flexible method of preparation, ease of surface modification, excellent environmental stability, ion exchange capacity and biocompatibility [3,7-9,10-11] . But one of the properties that restrict the development of electrochemically synthesized PPY film is its flat surface with limited surface area. This has been overcome to some extent by template methods. Method of polymerizing pyrrole within porous materials was used to enhance the surface area of PPY[10-11]. PPY films with sub-100-nm features were synthesized on atomically flat surfaces using adsorbed surfactant molecules as templates [12]. Arrays of PPY dots (80-180 nm diameter) were prepared by using diblock copolymer surface micelle arrays as the reaction template[13]. PPY nanotubes with average pore diameter of 6 nm were synthesized by using FeC3oxidant and V2O5nanofibers as the sacrificial template [14]. In addition, the method of

preparing multilayer polymer composite film on the base of PANI[15], polythiophene [PMET-PPY], polysiloxane[16], etc., was also employed to enhance the surface area of PPY and the continuous films with microscaled structure were obtained. While, few researchers reported the synthesis of continuous PPY fi- lms with nanostructrural surface morphology with a templateless method. In this study, we synthesized PANI/PPY bilayer composite films on ITO substrate by two-step constant potential electrochemical method. Our ultimate goal is to produce continuous PPY films with large surface area to ease the immobilization of enzyme and to enhance the concentration of enzyme redox centers. The PPY and PANI films were also separately prepared on ITO for a comparison. Scanning Electron Microscope and Atomic Force Microscope were used to observe the surface morphology. The PANI/PPY bilayer composite film on ITO was found to be made up of micro/nano domains, which may contribute in a remarkable increase of the surface area of the film. The H2O2amperometric biosensor was constructed by coating horseradish peroxidase (HRP) on the PANI/PPY bilayer composite film. Compared with the PPY or PANI film on an ITO substrate, the HRP-containing micro/nano structural PANI/PPY bilayer composite film could act as highly sensitive sensor for the enzymatically generated H2O2. The proposed biosensor permitted reliable determinations of H2O2by chronoamperometry analysis. The detection limit and sensitivity were found to be on the range of 0.3 -1.0 mmol/1 and 38.81 mA cm-1mol-1, respectively. This work was financially supported by the National Natural Science Foundation of China (No.50433020, 50520150165 and 50673083). The authors also would like to thank the financial support from the Research Fund for the Doctoral Program of Higher Education in China (No. 20060335078). [C444]

"8F-1 Integrated All-Optical Ultrasound Transducers"

A broadband all-optical ultrasound transducer has been designed, constructed and tested for high-frequency ultrasound imaging. It consists of a 3 mum PDMS layer sandwiched between a two-dimensional gold nanostructure and a 30 nm gold layer. A laser pulse at the resonance wavelength of the gold nanostructure is focused onto the surface for ultrasound generation, and a CW laser at a wavelength far from resonance is used as the probing beam. The signal to noise ratio of a pulse-echo signal from a 70 mum diameter transmit element combined with a 20 mum diameter receive element probing a near perfect reflector positioned 1.5 mm from the transducer surface is over 10 dB, and has the potential to be improved by at least another 40 dB, while the center frequency is 40 MHz with -6 dB bandwidth of 57 MHz. A high-frequency ultrasound array has been emulated using multiple measurements from the transducer while mechanically scanning an imaging target. Characterizations of the device's optical and acoustical properties, as well as preliminary imaging results, strongly suggest that all-optical ultrasound transducers can be used to build high-frequency arrays for real-time high-resolution ultrasound imaging. [C445]

"State-of-the-Art Photonic Nanostructure Devices"

Semiconductor photonic nanostructures, i.e. photonic crystals (PCs) and high index contrast structures (HICs), have become worldwide topics in this decade. They strongly control light emission and propagation, and so allows novel phenomena and device applications. PCs are artificial mult i-dimensional periodic structures whose period is of the order optical wavelength. Through active studies in these 20 years, their fundamental theory and fabrication techniques have been established, and now they are widely used as tools in other topics of photonics physics and optoelectronics, e.g. nanolaser and cavity QED, efficient light extraction in LEDs, high-power single mode VCSELs, slow light and optical buffering, nonlinear photonic switching, negative refractive optics. HICs have simpler structures and optical characteristics. They are particularly attracting attention in the field of Si photonics. This presentation reviews some of our research activities on these topics. [C446]

"Characterization of nanofilled epoxy varnish subjected to surface partial discharges"

An epoxy matrix varnish, used for topping treatment of electrical machines stators, was studied. The experimental nanocomposites were prepared using the same organically modified clay varying the mixing process. The nanostructure of each material was assessed by means of WAXRD. The homogeneity at the micron level was checked via SEM observations of brittle fractured sections. DSC analyses were conducted on both pure and nanofilled samples. Surface partial discharges resistance of both the nanocomposite varnishes and the traditional microcomposite, with the same epoxy matrix, was compared. Damages due to partial discharges were observed through optical microscopy and SEM, while an estimate of the surface erosion was obtained through roughness measurements. [C447]

"Nonlinear optical properties of some Au nanostructures"

The investigation of the nonlinear optical response of various Au nanostructures has been recently accomplished in our laboratory and some selected results concerning the nonlinear optical properties of these nanostructures will be presented and discussed. In particular, the third-order nonlinear optical response of nanometer thick Au

films and Au nano-island films, both deposited on transparent dielectric substrates, are going to be presented and discussed. In addition, the nonlinear optical response of Au nano-clusters encapsulated in block copolymer micelles will be also presented and compared with the other nanostructures. In all cases, the influence of the morphological characteristics of these structures on the nonlinear optical response will be discussed. [C448]

"Three-dimensional Nanomechanical Device Fabrication by FIB-CVD"

Three-dimensional nanostructure fabrication has been demonstrated by 30 keV Ga+FIB-CVD using a phenanthrene (C14H10) source as a precursor. The characterization of deposited film on a silicon substrate was performed by a transmission microscope and Raman spectra. This result indicates that the deposition film is a diamondlike amorphous carbon (DLC) which have attractive attention because of their hardness, chemical inertness and optical transparency. A large Young's modulus that exceeds 600 GPa seems to present great possibilities for various applications. These results demonstrate that FIB-CVD is one of key technologies to make 3D nanostructure devices in the field of electronics, mechanics, optics and biology. [C449]

"Near-Field Characterization of Plasmon Polariton Propagation Along Periodically Nano-Structured Metal Thin Films"

We operate a near-field optical microscope to investigate the properties of periodically nano-structured metal thin films designed to control at the micron scale the propagation or the excitation of surface plasmon polaritons. [C450]

"Computational lithography for nanostructure science and technology"

There are two paths to nanostructure patterning. Self-assembly is intriguing, as it makes use of the natural tendency of materials to spontaneously coalesce into shapes of technological importance without relying on complex, expensive tools to do the job. But the number of achievable shapes and workable materials is limited, placing severe restrictions on the types of nanostructures that can be achieved. More-or-less conventional deep ultraviolet (DUV) optical printing techniques have performed astonishingly well for features sizes below 90 nm. Electron beam technology has printed arbitrary patterns with minimum feature sizes on the order of 10's of nanometers. These techniques do not suffer from the same restrictions on form and materials as self- assembly. There are restrictions, though. We address one of these here: the degree to which patterns can be faithfully reproduced as feature sizes scale to smaller dimensions. [C451]

"Diamondoids in nanotechnology: First-principles simulation of electronic structure and nonlinear optical response in adamantane"

Diamondoids have been of great interest in recent years due to their role in nanotechnology, drug-delivery and medicine. Because of their six or more linking groups, they have found major applications as templates and as molecular building blocks in nanotechnology, polymers synthesis, drug delivery, drug targeting, DNA-directed assembly, DNA-amino acid nanostructure formation, and in host-guest chemistry. Here we present experimental investigations on the molecular nature of diamondoids and their molecular specificities, and we explore their intermolecular interactions and opto-electronic properties. [C452]

"Investigation of ZnO:In nanorods deposited by vapor cooling condensation method"

To improve the electrical conductivity of ZnO nanorods, indium-doped ZnO (ZnO: In) is a promising structure. ZnO:In nanorods were grown using vapor cooling condensation method at low temperature through anodic alumina membranes (AAM) in a thermal coater. With assistance of liquid nitrogen cooling system to cool the substrate and vacuum pumping system to provide the molecular rising force, the uniform and isotropy one-dimension ZnO nanostructure can be obtained by overcoming the obstructing problem of the AAM pores. The diameter and length of ZnO: In nanorods observed by SEM are about 200 nm and 100 nm, repectively. As a result of photoluminescence (PL) measurements, the difference of optical property between ZnO and ZnO:In nanorods can be observed. [C453]

"The study of One-dimensional Zinc Oxide Nanostructure Emitters"

Field emission display (FED) is a kind of vacuum electron device, and its principle is very similar to that of a traditional cathode ray tube (CRT). The display performances of a FED, such as emission current and the driving voltage, are determinated largely by the field emitters. Besides the emission characteristic, the geometric factors, thermal stability and ambient insensitivity of the field emitter are also very important in a FED device. One dimensional nano zinc oxide materials have the properties of high aspect ratio, good mechanical performance and chemical stability. In this paper, the emission stability of nano ZnO emitters which has the tetrapod-like

nanostructure, is studied. The ZnO cold cathode is fabricated with the screen printing method, and the emission characteristics are investigated in a vacuum microelectronic device using ITO anode. The emission stability recorded over time of the ZnO cathode is presented [C454]

"Field Eemission Resonances from Self-Aassembled Silicon Nnanostructures"

Summary form only given. Conventional Fowler-Nordheim theory of field electron emission describes the emission process as electron tunnelling from a Fermi sea through a surface potential barrier modified by an external electric field. However, a number of recent studies of field emission from nanometre-scale metallic systems reveal significant departures from this traditional description. In particular, the energy spectrum of electrons field-emitted from Au nanoclusters and W nanotips was found to consist solely of multiple peaks spread over a range of energies around the Fermi level. The existence of these peaks suggests that electrons do not tunnel directly from the bulk Fermi sea into vacuum; rather that tunnelling occurs through discrete energy levels formed in the nanotips due to spatial confinement. In this paper we report the field emission properties of self-assembled silicon nanostructures formed on an n-type silicon (100) substrate by electron beam annealing at 1000 degC for 15 s. The nanostructures are square based, with an average height of 8 nm and are distributed randomly over the entire substrate surface. Following a period of conditioning, the silicon nanostructure field emission characteristics become stable and reproducible with electron emission occurring for fields as low as 3 Vmum-1. With continued conditioning however, a number of discrete and highly repeatable current peaks develop which are superimposed on a background current well described by conventional Fowler-Nordheim theory. These current peaks are understood to result from enhanced tunnelling through resonant states formed at both the substrate-nanostructure and nanostructure-vacuum interface. Here will provide details of the experimental procedure and the corresponding experimental observations along with a theoretical model to account for the observed I-V characteristics [C455]

"Atom Probe Field Ion Microscopy and High Resolution Electron Microscopy: two complementary methods for atomic scale characterisation"

Summary form only given. Atom probe tomography is now a well recognized technique for both imaging and analyzing metallic materials at the subnanometer scale. The limitations of this techniques are mostly related to the smallness of the investigated volume, and to the limited microstructural information it can access. APT investigations are limited to volumes of about 100times100times100 nm3, which may not be fully representative of the materials microstructure. Therefore APT investigations are mostly combined with electron microscopy studies. On the other hand, APT offers a true subnanometer resolution. As compared to TEM related techniques, the major advantage of APT lies in its depth resolution, which overcomes the problem of depth sampling. Another major advantage of APT is that it also offers composition analysis capabilities with the same resolution, which can usually not be challenged by electron microscopy related techniques. On the basis of some selected metallurgical problems, the complementarity of both techniques will be highlighted, both in terms of structure and composition information: First, the nanoscale shell structure of Al3(ZrSc) precipitates is investigated. The combination of APFIM and HREM clearly proves the existence of a Zr rich shell surrounding a Zr depleted core, explaining the growth and coarsening behavior of these precipitates during annealing at 475degC. Second, a partially nanocrystallized amorphous Al92Sm8(at.%) alloy obtained by a rapid solidification process will be investigated. A unique characterization of the nanostructure combined with the atomic species distribution of the nanocomposite materials will be presented. The absence of excessive solute concentration at the interface nanocrystallites/amorphous matrix and the particle size (about 50-60 nm), higher than the one usually observed in similar alloys, can explain the excellent observed ductility of this nanocrystallized alloy. A- t last, the first experimental evidence of GP zones in a very dilute Fe-Nb-C-N model high-strength low alloy (HSLA) will be given. The precipitation sequence, from a random solid solution under the simple action of temperature, will be shown. In particular, we will focus on the evidence of monolayered NbN precipitates. A tentative structure will be proposed, based on the information derived from APT and HREM [C456]

"Fabrication and Field Emission of Flower-like ZnO Nanowhiskers"

Flower-like nanostructure zinc oxide (ZnO) whiskers have been fabricated on the patterned ITO electrodes with glass panel by a simple hydrothermal growth method. The field emission properties of the flower-like ZnO nano-whiskers have a low field emission threshold voltage (4 V at a current density of 0.1 mA/cm2) and a high current density 1 mA/cm2at an applied field of 6 V/mum. The low temperature process environment and good field emission properties satisfy with the requirements in the application of fabricating the cathode of field emission display device [C457]

"Electron Emission Properties of Diamond Nanocones on Freestanding Diamond Films"

Large-area diamond conical nanostructure arrays were formed on freestanding diamond films using a hot filament chemical vapor deposition system with negative biasing of the substrates. Results of scanning electron microscopy and transmission electron microscopy studies showed that the energetic methylic ions during the self-organized selective sputtering process dominantly contribute to the formation of diamond cone arrays with controlled morphology based on a neutral-ion charge exchange collision model. Field emission properties, measured by a home-made double probe scanning electron microscopy, presented lower threshold voltage and higher emission current density compared with those of planar diamond films. This study has opened the possibility of using diamond cone arrays as display device and point electron source with excellent electron emission ability [C458]

"Recent Developments in Microsystem- and Nanodevice-TCAD"

In this context, the author discussed the most important aspects and practical methodologies for setting up physically-based and consistent nanostructure, microdevice, and full system models for the effort-economizing and yet accurate numerical simulation of mechatronical microsensors and microactuators and complete microsystems built up of them. In this modeling framework, the author demonstrates the consistent treatment of coupled fields and coupled energy and signal domains (briefly, even though not very precisely termed "multi-physics modeling"), which is required for deriving micromechatronical macromodels on the system level from the continuous field level (so-called "order reduction process"), and we also address some important issues to be focussed on for the reliable validation and accurate calibration of the models [C459]

"Synthesis and thermoelectric properties of nano/micro-meter CoSb3-based bulks processed by in-situ spark plasma sintering"

Nanostructure materials exhibit different properties from those of corresponding bulk substances, the decrease in the grain size of the material leads to a drastic increase in the density of grain boundaries, which brings out a significant reduction in thermal conductivity, kappa, and so improve the value of thermoelectric figure-of-merit, ZT. But the decreased grain size reduces the electrical conductivity and Seebeck coefficient at the same time. Based on the above reasons, a novel method of in-situ spark plasma sintering (SPS) is used to synthesize CoSb3-based Skutterudite compounds with nano/micro-meter grains by controlling the grain size of raw materials, and the thermoelectric properties are studied systematically. The results indicate that, the ratio of electrical conductivity and thermal conductivity is optimized, and a relative high Seebeck coefficient is obtained at nano/micro-meter scale. As a result, the dimensionless figure of merit ZT is greatly improved for CoSb3, and La0.3FeCo3Sb12, the highest value of ZT of 0.34 and 0.72 is obtained at 700 K for CoSb3and La0.3FeCo3Sb12Skutterudite compound, respectively [C460]

"Study of electrically active defects in GaAs/InAs/GaAs QDs structures by DLTS and TEM"

The apparent C-V profiles and the deep levels in GaAs/InAs/GaAs quantum dot nanostructure, have been investigated by space charge spectroscopy techniques (C-V and DLTS). Accumulation peaks and/or depletion of free carriers at the QDs plane are observed under the considered growth parameters. It is shown that, both in the cap and at the QD-layer/cap interface, the deposition of InAs QDs induces deep levels which exhibit a logarithmic dependence of the DLTS signal amplitude from the pulse width. transmission electron microscopy (TEM) analysis shows extended defects in the cap and near the QD/cap interface, which have been correlated to electrical measurement results [C461]

"Laser Atom Probe Tomography: Application to Polymers"

In this paper, data on laser local electrode atom probe (LEAPreg) investigations of alkanethiol self-assembled monolayers (SAMs) and poly-3-alkylthiophenes (P3ATs) are presented. Alkanethiols represent an opportunity to understand atom probe tomography (APT) field ionization and reconstruction issues, as applied to polymers, at their most basic level. Laser LEAPreg coupled with APT applied to polymers can provide a direct probe of nanostructure by way of observed molecular fragment distributions [C462]

"Nanostructured Photonic Crystal Fiber with Ultra-high Birefringence"

A nanostructured photonic crystal fiber (PCF) with elliptical air holes in the fiber core is proposed. Both ultra-high birefringence and ultra-low confinement loss can be achieved simultaneously in a large wavelength region for a PCF with only four rings of arrays of circular air holes in the fiber cladding. Uniform and ultra-high birefringence can be achieved by employing elliptical air holes both in the fiber cladding and fiber core. The proposed method by employing nanostructured air holes in the fiber core is also expected to optimize other characteristics (such as dispersion) of the PCF. [C463]

"Thermoelectric Power of Single Bi Microwires at Helium Temperatures"

The thermopower S has two contributions. Diffusion thermopower arises from a diffusion of charge carriers opposite to the temperature gradient; phonon drag thermopower results from a quasi-momentum transfer from the phonons to the charge carriers. The latter term is dominant at low temperatures, yields important information about phonon-wall scattering in nanostructures, and has been studied in confined systems such as two-dimensional electron gases and carbon nanotubes. The thermopower of monocrystalline Bi (pure and doped with Te or Sn) microwires with diameters ranging from 0.1 to 3 mum were measured in the temperature range 4-300 K. Samples of Bi nanowires that are monocrystalline were spun as a fiber by the high frequency liquid-phase casting method. The low-temperature diffusion thermopower of Bi is linear with temperature. Instead, the dominant feature of the thermopower at temperatures below 12 K is a peak, which is due to phonon drag. We observe that the phonon-drag thermopower depends on the wire diameter and increases with increasing diameter of the sample, which is qualitatively explained by the suppression of two-step phonon processes in the finer wires due to the shortening of the phonon mean free path for normal (momentum conserving) processes due to diffusive wall scattering [Gitsu, D, et. al., 2005]. We have also studied the dependence of the phonon drag peak with wire length. Thus we have observed considerable decreasing of the phonon drag in the short samples when the length of the samples is smaller than 1 mm. In this case only thick samples d = 2.5 and 1 mum have the appreciable positive peak at around ap5 K. A possible explanation of these experimental results is presented [C464]

"Simulation Study of Screen Effects on Field Emission from Multiple One-dimensional Nanostructures Grown on Silicon Substrates"

Summary form only given. In our previous work, a classical carrier transport model is established to study the junction effects on the field emission currents of the narrow- and wide-band-gap single one-dimensional nanostructure grown on n-type and p-type doped silicon substrates. Our simulation results agree with the experiments qualitatively and provide a perspicuous explanation for the junction effects by using the band structure theory. But the screen effects of the multiple nanostructures on the band structures around the nanostructure-substrate interface and on the field emission currents are not clear yet. In this study, the carrier transport model mentioned above is applied to investigate the screen effects of the multiple one-dimensional nanostructures. The classical transport equation is used to describe the carrier transport in the material and solved together with the Poisson's equation. The field emission at the emitter-vacuum interface is modeled by the Fowler-Nordheim equation. For studying the interaction between the multiple nanostructures, two nanorods with different heights and distances in the simulation domain are modeled and accompanied with a pair of periodic boundary conditions. Figure 1 presents the geometry model in this research. The CNT and SiCN 1-D nanorods are grown on n/p-type Si substrate with the doping concentration of 1015l/cm3. Figure 2 and 3 present the electrostatic contours, the band diagrams for the side nanorods and the F-N plots for the SiCN nanorods with n-type substrate and inter-rod distances of 0.1 mum and 0.3 mum, respectively. Our simulation results exhibit that when two nanorodes are close, the screen effects will distort the electric potential distribution around the nanorods and change the band structure at the nanostructure-substrate interface. Therefore, the field emission characteristics are very different for each nanorod in the closely-aligned nanostructure arrays [C465]

"Effect of External Field for Polypyrrole Polymerization"

Summary form only given. Polypyrrole(PPy) is one of the most stables conducting polymers due to its high thermostability and life stability. In general, it has been known that PPy films can be synthesize by anodic electropolymerization, oxidative chemical polymerization and plasma enhanced polymerization. We have synthesized polypyrrole(PPy) nanofilms using vapor-phase oxidative polymerization process in a vacuum chamber under ultraviolet (UV) photon irradiation. That time, we measure the current through conducting polymer connected with two electrodes by Kiethley 2400 multimeter. Vapor-phase polymerization techniques for the preparation of PPy of nanofilm type require that pretreated substrates be essentially activated with inhibitor. In this case, an insulating substrate is pretreated with polymer containing electron acceptors and initiators such as ferric chloride. PPy nanofilm that was irradiated by UV photon are rapidly synthesized and current of two electrodes increased. These PPy nanofilms are characterized by atomic force microscopy (AFM), Raman spectroscopy, Fourier-transform infrared spectroscopy (FT-IR) and field emission scanning electro microscopy (FE-SEM). Possible mechanism is proposed for the formation of the PPy nanostructure during the vapor-phase oxidative polymerization [C466]

"Field Electron Emission from GaAs Nanowhiskers Fabricated by MBE"

This paper investigated the electron emission properties of self-assembled GaAs nanowhiskers (NWs) grown by MBE which includes electron emission current, potential difference dependences in the vacuum gap between

the probe tip and GaAs NWs surface. The analysis shows that the electron emission from the NWs nanostructure surface is the result of electron tunneling from the indicated above surfaces into the probe material. The question of barrier shape still remains open. Possible influence of size effects for GaAs NWs was not revealed. The estimates of the emission current density have shown that the current density is very high and equal to about 105A/cm2 [C467]

"A novel approach to integrating three dimensional carbon nanostructures with electronic circuitry"

Summary form only given. The controlled synthesis of three dimensional carbon nanostructures, such as nanotubes and nanofibers, has been extensively studied and described. The process typically involves a chemical vapor deposition at high temperatures to catalyze three dimensional growth. The harsh growth conditions are a limiting factor for applications that require the synthesis of carbon nanostructures on existing electronic circuitry. We report on a novel method for integrating three dimensional carbon nanostructures, produced in high temperature processes, with CMOS circuitry [C468]

"Field Emission Characteristics of Carbon Nanocoils Grown on Copper Micro-tips"

Carbon nanocoils (CNCs) were synthesized by using thermal chemical vapor deposition of C2H2and NH3gas at 600degC over copper micro-tips formed on silicon substrate. Copper micro-tips were formed by the high current pulse electroplating in order to investigate the effect of the surface morphology of the substrate on the growth of carbon nanostructures. We prepared three kinds of substrates with surface of electroplated copper micro-tips, electroplated copper film and evaporated copper film. Among the substrates, CNCs grown on the copper micro-tips showed the highest field emission characteristics [C469]

"A study about electrical treeing in different EVA-layered silicate nanostructured compounds"

Electrical treeing in polymeric insulation is potentially a nano-structure dependent phenomenon. The present work is part of a preliminary study on electrical treeing in EVA-layered silicate nanocomposites having different morphology. Two parameters have been mainly considered: the treeing inception voltage (TIV) and the breakdown voltage (BDV). These parameters, especially the TIV, have shown a significant increase in the intercalated nanocomposite materials. The outcomes strengthen the concept that interface interactions due to the nanostructure can improve the treeing resistance of polymeric compounds [C470]

"Self-Regulated Bio-Nanostructured Membranes for MEMS"

This paper describes a novel self-regulated bio-nanostructured membrane designed for MEMS. The membrane has a unique, rigid three-dimensional nanostructure with nano-pores that are formed by the motions of bacteria. The properties of this material and its suitability for sorting or filtration systems were evaluated. Since the self-regulated bio-nanostructured membrane is consisting of ultrafine rigid fibrils, and scale of which is 100 to 1000-fold smaller than conventional fibers, the membrane resisted up to 2 MPa of pressure without any clogging, whereas conventional membrane withstood less than 0.5 MPa. [C471]

"Directly Pumped Crystalline Silicon Laser-An Impossible Possibility?"

Lasing at 1.28 mum was observed in a crystalline silicon structure under direct optical pumping, but is beyond the reach of optical lithography in feature size and beyond that of the e-beam lithography in field size. It is accomplished in this work through the use of a non-lithographic self-organized nanopore array membrane as an etch mask. The anodic aluminum oxide (AAO) nanopore etch mask was placed atop a thin SOI layer which was insulated from the thick silicon substrate by 3 mum of silicon-oxide. The nano patterning was achieved via reactive ion etching (RIE) which introduced nanopores to the silicon. The resultant silicon nanostructure consists of a periodic array of nanoscale high-density emissive structural deformation (ESD) zones [C472]

"Plasma nanoscience: from nature's mastery to deterministic plasma-aided nanofabrication"

Summary form only given. Plasma nanoscience is an emerging research area at the cutting edge of the physics of plasmas and gas discharges, nanoscience and nanotechnology, materials science and engineering, and structural chemistry. The existing approaches to fabricating exotic nanostructures and functional nanofilms are mostly process-specific and suffer from cost-inefficient "trial and error" practices. One of the reasons is that the ability to control the generation, transport, deposition, and structural incorporation of the building units of such films and structures, still remains elusive. On the other hand, the pioneering concept of deterministic plasma nanoscience is treated with extreme caution due to inherent chaotic nature of the plasma at the microscopic level. This contribution shows how to challenge one of the previously intractable problems of bridging nine orders of magnitude between the sizes of plasma nanofabrication facilities (~0.5 m) and self-organization of adsorbed

building units on solid surfaces (~0.2 nm). One of the possibilities is to manipulate the ionic building blocks in the non-neutral layer of space charge that separates the plasma and solid surfaces and control self-organization of nanostructure building blocks on plasma-exposed surfaces and their insertion into the nanoassemblies. The results of advanced computer simulation allow one to obtain the microscopic topology of ion fluxes in the vicinity of selected functional nanostructures and the arrangement of adsorbed species into nanopatterns on solid surfaces. These results are linked, via the sheath parameters, to the building unit densities and energies in the plasma bulk and eventually to the process control parameters. On the other hand, the desired nanoassemblies can be engineered by using atomistic ab initio density functional theory approaches. Recent experimental and computational results obtained within the International Research Network for Deterministic Plasma-Aided Nanofab--rication suggest the possibility of deterministic synthesis of conical nanotip structures for electron microemitter arrays, and are discussed in this talk. Finally, this talk reveals how the Nature's mastery works in the self-assembly of nanometre-sized particles in the Universe and of exotic nanoassemblies in laboratory plasmas [C473]

"Fabrication of Periodic Nanostructure in Nanoimprint Process"

In this paper nanoimprint molds with 50nm and 100nm feature size nanostructure were fabricated. The periodic pattern of a positive resist was formed on silicon wafer by electron beam lithography, and then the nanostructure of Si was etched using an inductively coupled plasma reactive ion etching (ICP-RIE) system. During the etching process, different ratio of C4F8gas was added to the original etching gases SF6/O2. By increasing the C4F8gas, the sidewall protection was improved. The C4F8gas also increased the etching resistance of the electron beam resist, and the nanoseale resist patterns were maintained through the etching process. The resist was removed after etching, and then the 50nm periodic nanostructure with aspect ratio 6 was obtained. To achieve nanoimprinting process with less damage, the possible sources of stresses resulting from the molding/demolding process, film solidification and thermomechanical mismatch during cooling were studied. [C474]

"Polarization Control via Tunable Nano-Structures in PDMS"

We propose a compact and low-cost design for polarization control using tunable form-birefringence on PDMS nanostructures fabricated by nano-imprint lithography (NIL). The operation principle is demonstrated in a fabricated device by changing the nanostructure electrostatically [C475]

"Tailored Stress in InP/GaInAs Layers for InP/Air-Gap DBR-Filters with Photonic Crystals"

A detailed investigation on the control of residual stresses, especially gradient stress, in InP/air-gap structures is presented. Free standing cantilevers with stress compensation by Ga0.03In0.97P layers of various thicknesses and by a variation of V/III flux ratio in growth direction were fabricated, leading to controlled stress properties. White light interferometry was used for evaluation of the gradient stress values [C476]

"Design automation for DNA self-assembled nanostructures"

DNA self-assembly is an emerging technology with potential as a future replacement of conventional lithographic fabrication. A key challenge is the specification of appropriate DNA sequences that are optimal according to specified metrics and satisfy various design rules. To meet this challenge we developed a thermodynamics-based design automation tool to evaluate the vast DNA sequence space (2.8k base pairs) and select appropriate sequences. We use this tool to design DNA nanostructures that were previously impossible with existing text distance based tools. We also show that for nanoscale structures our approach produces superior results compared to existing tools [C477]

"A Nano-MOS Array: Metallic Carbon Nanostructure Connected with Nanoscale SiO2 Islands inside Insulated Alumina Nanochannels on Silicon Substrate"

A nano-MOS array consisting of metallic carbon nanostructures connected with nanoscale SiO2islands inside insulated alumina nanochannel on silicon substrate was fabricated via Si-based porous anodic alumina (PAA) template. The electrical properties of the nano-MOS array were studied by means of current-voltage (I-V) and frequency dependent capacitance-voltage (C-V) tests. This structure is important to the application of carbon nanostructures and PAA template and has high potential in future nanoelectronics applications. [C478]

"Defect Engineering in Nanoscale Semiconductors through Surface Chemistry"

In the same way that gases react with surfaces from above, bulk point defects such as interstitial atoms and vacancies can react from below. Little attention has been paid to this form of surface chemistry, although it is very important for nanoscale semiconductor devices where all regions are in close proximity to a surface or

interface. Recent solid-state diffusion measurements and modeling in our laboratory have shown that reactions between defects and semiconductor surfaces can play the dominant role in regulating defect concentrations. Furthermore, the rates of these reactions can be controlled through submonolayer gas adsorption. There are two separate mechanisms for using the surface to control bulk defect concentrations. The first mechanism involves reflecting charged defects from the surface due to electrically active surface defects that set up a repulsive electric field. The second mechanism involves the exchange of defects with surface dangling bonds. Taken together, these observations point to entirely new possibilities for controlling and manipulating defects in semiconductor nanostructure fabrication. [C479]

"Silicon-based nanomembrane materials: the ultimate in strain engineering"

The lattice-mismatch-induced strain in growth of Ge on Si produces a host of exciting scientific and technological consequences, both in 3D nanostructure formation and, when silicon-on-insulator (SOI) is used as a substrate, in 2D membrane fabrication. One can use the ideas of strain sharing and critical thickness, combined with the ability to release the top layers of SOI, to create freestanding, dislocation-free, elastically strain relieved flexible Si/Ge membranes with nanometer scale thickness, which we call NanoFLEXSi or Si nanomembranes (SiNMs). The membranes can be transferred to new substrates, producing the potential for novel heterogeneous integration. The very interesting, and in some cases surprising, structural and electronic properties of these very thin membranes have been revealed using STM, X-ray diffraction, and electronic transport measurements. For example, STM shows that conduction in very thin Si layers on SOI with bulk-Si mobilities is possible even though the membrane is bulk depleted. Using the effect of elastic strain, we have fabricated two-dimensional electron gases (2DEGs) in membrane structures; we support the transport measurements with calculations suggesting that we are observing a single bound state in the well. We have fabricated thin-film transistors (TFTs) that we have transferred to flexible-polymer hosts that show a very high saturation current and transconductance. Thus very highspeed flexible electronics over large areas become possible [C480]

"Nanotripods of Zinc Oxide"

We report the discovery of two-dimensional (2-D) nanotripods of ZnO, a new member of the ZnO nanostructure family. These planar nanotripods are synthesized via a novel approach known as catalyst-free combust-oxidized mesh (CFCOM) process that we developed using a ZnO factory furnace. At about 1200 °C, high velocity zinc vapor is instantly oxidized and captured in a steel mesh for 20s and then air-quenched. From this subminute synthesis process, three types of polycrystalline 2-D tripodal nanostructures are discovered. The ZnO tripods are composed of three planar arms that appear as rectangular nanoplates. We propose two growth routes for these planar tripods, namely base-arm and tripodal-core routes. For the former route, growth begins with the base arm in [[unk] [unk] 20] direction. During quenching, the other two arms grow from newly formed tapered facets, ([unk]110) and (1[unk]10). The tripodal-core growth route involves the formation of a hexagonal disc with ±(0002) larger surfaces. From this core, three arms grow simultaneously in [11[unk]0], [[unk]10] and [1[unk]10] directions, while the core transforms into a Y-shaped configuration with ±(10[unk]0), ±(01[unk]0) and ±([unk]100) planes. Morphological analyses are performed using FESEM, EDS, TEM and XRD. Photoluminescence test detects the presence of structural defects associated with green and red peak emissions. [C481]

"ZnO Nanobelts/wire for Electronic Detection of Enzymatic Hydrolysis of Starch"

The hydrolysis of starch converting into glucose, cyclodextrins and other monomer products is very critical in food and pharmaceutical industries. The conventional methods of testing the hydrolysis products are cumbersome and time consuming. The single-crystal zinc oxide (ZnO) structures are quasi-one dimensional semiconducting nanostrucrures, and open a new field of biosensor technology for fabricating highly sensitive biosensors for the detection of protein, peptide, DNA/RNA, and enzyme-catalyst events in real-time mode. We synthesized ZnO nanobelts/wires, and modified surfaces by coating with silicon nitride (Si3N4) to protect nanostructure from process treatment. The nanostrucrures were coated with dilute aqueous starch solution, and electrical impedance measurements were recorded for both control and test samples. The test samples were hydrolyzed using amyloglucosidase enzyme (AMG). The SEM analysis showed degradation of the starch on the surface of ZnO nano-belts, whereas the starch remained intact on the control samples. The electrical impedance measurements showed shift in electrical impedance on test samples, whereas in control samples it remained static. The details of experimental results of electronic sensing of hydrolysis and advantages of the lab-on chip are discussed. This is the first report of electronic detection of starch hydrolysis using ZnO nanobelts/wires [C482]

"Spin-transfer torque switching in magnetic multilayers"

In this paper, we point out how the magnetization switching depends on the nanostructure geometry and material parameters. The micromagnetic study is carried out on multilayer nanodevices of Permalloy (Py)/CU/Py and Co/Cu/Cu with different cross section. Results show that the switching time is strongly dependent on the magnetization saturation of the material [C483]

"Enhanced Control of Morphology in Thin Film Nanostructure Arrays"

Glancing angle deposition (GLAD) was used to grow thin films of silicon and titanium dioxide slanted post nanostructures onto periodically patterned substrates. The patterned substrates consisted of tetragonal arrays of small hillocks with periodicities of 100, 200, and 300 nm. An advanced substrate rotation algorithm called PhiSweep was used during the deposition. The PhiSweep algorithm consists of rotating the substrate back and forth such that the arriving vapour flux direction alternates from either side of desired column tilt direction. This reduces the anisotropy of the shadowing conditions, which diminishes column fanning. The tilt angle of the columns is affected by the PhiSweep parameters, which is important in applications such as square spiral photonic crystals. This relation is derived and confirmed with tilt angle measurements of the slanted post films. The films grown using the PhiSweep method were compared with similar films grown using traditional GLAD. The PhiSweep technique produced films which conformed to the initial periodic pattern much better than the films grown with traditional GLAD, enabling the growth of nanostructure arrays with smaller periodicities. [C484]

"Novel Zinc Oxide Nanostructured thin Films for Volatile Organic Compaunds Gas Sensors"

Novel zinc oxide nanostructured thin films have been obtained by chemical deposition technique and rapid photothermal processing (RPP). ZnO nanostructures were studied for the development of volatile organic compounds (VOC) sensors. The investigations results indicate that by RPP is possible to control the sensing properties and operating temperature. A correlation taking into account the nanostructure of the material, the effects of the dopants, RPP and the response of the VOC sensor was established [C485]

"High Energy Density Magnetic Materials for Electronic Packaging"

Permanent magnet materials are of growing interest to the electronics industry and to manufacture of electromechanical devices, where they constitute indispensable elements in many electronic apparatus, circuits, electric motors. The permanent magnets have a major influence on the size, efficiency, stability and the cost of these systems and devices. The development of the rare earth magnetic materials (starting with 70's) has influenced significant and positively the application of the permanent magnetic materials owing to their large energy product and increased volume efficiency. The further improvement of current magnetic materials relies on nanostructuring. An example of improving the performance of magnetic materials by nanostructuring is the magnetic nanocomposites, constituted by a hard magnetic phase and a soft magnetic phase. The adding of the soft magnetic phase to the hard phase in a suitable nanostructure improves the permanent magnet performances beyond that of the hard phase, due to the exchange interaction. The paper reviews the current hard magnetic materials prepared by powder metallurgy: NdFeB sintered and bonded magnets and presents the researches concerning the new generation of hard magnetic materials: Nd2Fe14B/alpha-Fe nanocomposites. A special attention is accorded to the binary Fe-Cu system. The paper presents also the results related to the preparation and complex characterization of the Fe-Cu composites [C486]

"Characterization of Nanoparticles of Lead Free Solder Alloys"

Nanoparticles of Sn-4.0Ag-0.5Cu and Sn-0.4Co-0.7Cu (wt% composition) lead free solder alloys were manufactured and characterized for potential applications in microelectronics packaging. Scanning electron microscopy (SEM) analysis was carried out in order to study the morphology and size distribution of the nanoparticles. It was observed that nanoparticles of lead free alloys were almost spherical in shape. The observed size distribution of both lead free solder alloy nanoparticles is between 20 ~ 80 nm. High resolution transmission electron microscopy (HRTEM) was used to analyse the detailed nanostructure and oxide layer present on the nanoparticles surface. The observed oxide layer thickness is about 25Aring (2.5 nm). The depression in melting point due to nanosize effect was calculated theoretically as a function of particle size for the above mentioned lead free solder alloys and the theoretical results were compared with differential scanning calorimeter (DSC). Onset calculation was used to determine the depression in melting point due to nanosize effect in respect to bulk material. The melting point difference obtained by DSC for Sn-4.0Ag-0.5Cu and Sn-0.4Co-0.7Cu lead free solders are between 1.1 to 7.8degC and 0.24 to 2.4degC respectively depending on the definition of the melting point determination by DSC [C487]

"Metallic Carbon Nanotube Interconnects, Part II: a Transmission Line Model"

In this paper a transmission line model is derived to describe the propagation along single-wall carbon

nanotubes, candidate to be used as interconnects in nanoelectronics applications. The model is obtained in a consistent way from a fluid model of the electron conduction along such a nanostructure. The per-unit-length parameters are strongly dependent on the effects related to the electron inertia and the quantum fluid pressure. The values of the signal propagation velocity, characteristic impedance and characteristic damping of the obtained transmission line are very different from that obtainable, in principle, by ideally scaling the conventional technology. A successful benchmark test with a full-wave model is presented and some case-studies are carried out to investigate the possibility to use such structures as the future interconnects [C488]

"Biomolecular mechanism of silica synthesis opens novel routes to low-temperature nanofabrication of semiconductors and other advanced materials"

Summary form only given. Biological systems fabricate multifunctional, high-performance materials at low temperatures and near-neutral pH with a precision of three-dimensional nanostructural control that exceeds the capabilities of present human engineering. We discovered the mechanism governing the nanofabrication of silica in a biological system, and translated this mechanism to develop a new low-temperature route for the synthesis of a wide range of nano structured metal oxide, -hydroxide and -phosphate semiconductor thin films without the use of organic templates. As a first proof of principle, we have used this process for the low-temperature synthesis of a strongly photo conductive cobalt hydroxide-based thin film material never before attainable through conventional or high-temperature methods. This new biologically inspired synthesis method yields exceptionally pure inorganic semiconductors, and thus is potentially integrable with conventional manufacturing methods. In research leading to these developments, we discovered that the silicateins, a family of enzyme proteins we found occluded within the silica needles made by a marine sponge, can catalyze and structurally direct the polymerization of silica, silsesquioxanes, organometallics and a wide range of metal oxide semiconductors from the corresponding molecular precursors at neutral pH and low temperature. These were the first reported examples of enzyme-catalyzed, nano structure-directed synthesis of semiconductors. Interaction with the template-like protein surface stabilizes polymorphs of these materials (e.g., the anatase form of titanium dioxide and the spinel polymorph of gallium oxide) otherwise not formed at low temperatures. This observation and the preferential alignment of the Ga2O3 nanocrystallites suggested a pseudo-epitaxial relationship between the mineral crystallites and specific functional groups on the templating protein surface. As described above, we have used this biologically inspi--red process for the low-temperature synthesis of a large number of metal-oxides, -hydroxides and -phosphates, producing many in forms that could not be attained by conventional syntheses. The electronic properties of these novel materials suggest strong advantages for energy applications [C489]

"2006 International Conference on Numerical Simulation of Semiconductor Optoelectronic Devices"

The following topics were dealt with: novel materials; microscopic simulation of semiconductor lasers in GaInNAs material system; GaInNAs/GaAs quantum wells; GaN-based devices; nanostructures; photodetectors and solar cells; laser diodes; optoelectronic integrated circuits; semiconductor optical amplifiers; photonic crystal devices; microoptical elements; fibre optics and networks; light emitting diodes; and photonic circuits [C490]

"Carbon-based nanostructures as interconnects in electrical and biological systems"

Recent fundamental studies have given rise to the emergence of new applications for carbon-based nanostructures in electrical and biological systems. In this paper, our recent work investigating the utility of carbon nanotube (CNT) and carbon nanofiber (CNF) devices in electrical and biological interconnect systems is reviewed. Electrical and structural characterizations of carbon nanostructure arrays are performed to assess the viability of these novel forms of carbon for interconnect applications. Structural information of carbon nanofiber arrays obtained with high-resolution scanning transmission electron microscopy (STEM) are correlated with electrical characteristics using a semi-empirical model developed based on graphite conduction principles. Concurrently, a microelectrode array consisting of a two-dimensional (2D) pattern of CNT recording sites is used to detect the electrical signals in embryonic rat hippocampal neurons in vitro. This experiment demonstrates the viability of using CNT to electrically probe living cells [C491]

"Magnetic Field Driven Waveguide with Metallic Nanostructure"

The changes in the propagation constant of the H10mode of a rectangular waveguide with a metallic nanostructure, occurring under an external magnetic field have been investigated. Expressions for complex reflection and transmission coefficients have been derived. The dependence of the reflection coefficient on the intensity of the external magnetic field is analyzed. It is shown that the experimental values of the propagation constant or the reflection and transmission coefficients can be used to estimate the value of the microwave magnetoresistance of nanostructures. Experiments on the measurement of the reflection and transmission

coefficients in a waveguide with an (Fe/Cr)n nanostructure have been performed in millimeter and centimeter wave bands [C492]

"Interface Characterization for Vertically Aligned Carbon Nanofibers for On-chip Interconnect Applications"

Nanostructure characterization of carbon nanofibers (CNFs) for on-chip interconnect applications is presented. We propose a novel technique for characterizing interfacial nanostructures of vertically aligned CNFs, optimally suited for cross-sectional imaging with scanning transmission electron microscopy (STEM). Using this technique, vertically aligned CNFs are selectively grown by plasma-enhanced chemical vapor deposition (PECVD), on a substrate comprising a narrow strip (width ~100nm) formed by focused ion beam (FIB). Using high-resolution STEM, we show that CNFs with diameters ranging from 10-100 nm exhibit very similar graphitic layer morphologies at the base contact interface [C493]

"Carbon Nanotube Interconnects in Electrical and Biological Systems"

Recent fundamental studies have given rise to the emergence of new applications for carbon-based nanostructures in electrical and biological systems. In this paper, our recent work investigating the utility of carbon nanotube (CNT) and carbon nanofiber (CNF) devices in electrical and biological interconnect systems is reviewed. Electrical and structural characterizations of carbon nanostructure arrays are performed to assess the viability of these novel forms of carbon for interconnect applications. Structural information of carbon nanofiber arrays obtained with high-resolution scanning transmission electron microscopy (STEM) are correlated with electrical characteristics using a semi-empirical model developed based on graphite conduction principles. Concurrently, a microelectrode array consisting of a two-dimensional (2D) pattern of CNT recording sites is used to detect the electrical signals in embryonic rat hippocampal neurons in vitro. This experiment demonstrates the viability of using CNT to electrically probe living cells [C494]

"Nanophotonic traceable memory based on energy-localization and hierarchy of optical near-fields"

Optical near-field interactions allow energy localization at scales smaller than the diffraction limit of light. They also show hierarchical responses, meaning that optical near-fields exhibit different physical behavior at different scales. In this paper, by combining these properties of optical near-fields, that is, energy-localization and hierarchy, we present a novel traceable optical memory that records the event of memory access to each of the bits, which is useful in applications such as high-security information transfer. The basic principle is numerically demonstrated using a metal nanostructure. [C495]

"Nanostructural Investigations of Optical Materials and Devices Surfaces by Means of Scanning Probe Microscopy"

The optical material's and device's surfaces have been investigated by means of scanning probe microscopy. As a result of researches the techniques of measurement, the analysis of a surface of optical glasses, fiber-optical systems and laser elements have been developed [C496]

"Confocal nonlinear optical microscopy for high resolution measurement of tea-leaf cells"

High-resolution optical microscopy is very important in various applications including biological-cell imaging. In this paper we propose a new type of confocal microscopic spectroscopy to use a nonlinear absorption of the biological cells without doping fluorescent dyes. The confocal nonlinear optical microscopy by use of wave mixing geometry can observe a nanostructure of the cell inside. A three dimensional structure of a green-tea-leaf cell which had a weak absorption at a wavelength of 633 nm is measured [C497]

"ZnO Nanotip-based QCM Biosensors"

The medical diagnostics laboratories are showing an urgent need for accurate, fast and inexpensive biosensors. A zinc oxide (ZnO) nanotip-based quartz crystal microbalance (QCM) sensor is developed as a solution for accurate and inexpensive biosensors. The QCM sensor composed of single crystalline ZnO nanotips grown on top of a gold electrode using metal-organic chemical vapor deposition (MOCVD). Scanning electron microscopy (SEM) shows that the ZnO nanotips are uniformly aligned with their c-axis normal to the gold surface, giving a large surface area for sample up-taking. The ZnO nanotip coated QCM sensor shows a 10-time larger frequency shift than that of regular QCM sensors, when measuring the same DNA oligonucleotide (5'-AGAAAATCTTAGTGTC-3') solution. In addition, the hydrophilic behaviors of the nanotip array significantly reduce the required liquid volume for effective detection. 0.5 mul solution fully covers the QCM sensor area (0.2047 cm2), while a minimum of 16 mul liquid is required to cover a flat surface of the conventional QCM. ZnO

nanotips show superhydrophilicity with a contact angle of ~0deg under ultraviolet (UV) illumination. The superhydrophilic sensor surface significantly boosts the solution taking up ability; therefore, enhances the sensitivity of the QCM sensor. The effects of ZnO nanostructure on the bulk acoustic wave (BAW) are also discussed [C498]

"Advanced Metal Nanostructure Design for Surface Plasmon Photonic Bandgap Biosensor Device"

First Page of the Article [C499]

"Organic memory device using tailored nanostructure of conducting polymer"

In this presentation, a simple printing method to fabricate molecular memory cells will be presented using tailored nanostructure of poly(ethylenedioxythiophene) derivatives (PEDOTD). Synthetic approach to tune the nanostructure of PEDOTD and it's electrical properties will be presented with the printing condition, NDR effect, and characteristics for molecular electronics. [C500]

"The Use of Photoluminescence Spectra of TiO2 Nanoparticles Coated With Porphyrin Dye Thin Film for Grading Agarwood Oil"

This paper explores the possibility using nanostructure thin film of TiO2nanoparticles coated with porphyrin dye based on fluorescence technique to grade agarwood oil. The sensing material was prepared using synthesized of TiO2nanoparticles colloid is in a sol-gel form. Then the nanoparticles were coated with dye, Iron (III) meso tetraphenyl porphine chloride. The coated nanoparticles were deposited on quartz substrate using self- assembly through dip coating technique. The sensing properties of the thin film toward five grades of agarwood oil were studied using luminescence spectrometer. It was found that the thin film produced different emission spectra peaks for different grades of agarwood oil. Hence the thin film potentially be use as sensing material for grading agarwood oil and others nature product for the future. [C501]

"Characterization and properties of a textured silicon surface with nano-porous layer"

The nano-structural anti-reflection layers were investigated. Nano-porous layer was formed on Si substrates by electrochemical etching in HF-based electrolyte. Porous Si layer on the front surface of n+/p monocrystalline, textured Si substrate have been investigated with the aim of improving the performance of silicon solar cells, because an antireflection coating and a surface passivation can be obtained simultaneously in one process. The nanostructure of porous Si is well aligned with the underlying crystalline Si lattice. The formation of a porous Si layer about 100 nm thick on the textured silicon wafer result in an reflectance lower than 5% in the wavelength region from 500 to 900 nm. Such a surface modification allows improving the Si solar cell characteristics. [C502]

"Localized field enhancement in metal films using an overlapping double-hole nanostructure"

Eight orders of magnitude enhancement in the local energy density is shown in a novel design of an overlapping double-nanohole array structure. [C503]

"Transition radiation in multilayer nanostructures as a medical source of hard-X-ray radiation"

We show that periodic nanostructure made of alternating layers of Ag and Mo can serve as an efficient source of hard X-ray transition radiation for medical applications, which uses low energy electrons. [C504]

"Advanced Magnetic Nanostructure Characterization via Resonant Soft X-Ray Spectro Holography Imaging in Combination with Microscopic Hysteresis Loop Analysis"

In this article the coherence and tunable polarization of soft X-ray synchrotron radiation for imaging magnetic nanostructures via Fourier Transform Holography is discussed. This new lens-less imaging technique is based on the direct Fourier inversion of a holographically formed soft X-ray interference pattern. This is based on placing the sample behind a lithographically manufactured mask with a micron-sized sample aperture and a nano-sized reference hole. By exploiting the magnetic dichroism in resonance at the L3 edges of the magnetic transition metals (wavelength ~ 1-2 nm (700-900 eV)), images of magnetic nanostructures have been obtained with a spatial resolution of 50 nm. The technique is transferable to a wide variety of specimen, appears scalable to diffraction-limited resolution (about 2 nm), and is well suited for ultra-fast single-shot imaging with future X-ray free electron laser sources. [C505]

"Magnetization process of Ni membranes with controlled highly ordered nanohole arrays"

In this work, preparation and characterization of magnetic metallic membranes with well ordered nanoholes that gives rise to particular magnetization process is focused. This nanostructure has been achieved by controlled replica/antireplica processes starting from highly ordered nanoporous alumina membrane. [C506]

"High Coercivity of Co-ferrite films prepared by sol-gel method"

This paper investigates the magnetic properties of Co-ferrite (CoFe2O4) thin films deposited by sol-gel method with spin coating, especially coercivity related to the nanostructure of the films varying film thickness and annealing temperature. High coersivity of around 6 kOe and high magnetization of over 250 emu/cm3 were obtained in these thin films. The microstructure of the films with high coercivity were columnar that appeared 875K which showed magnetic anisotropy. [C507]

"Stability Model for Ultra-thin Lubricant Films with a Slider"

This paper investigates a thermodynamic stability model that defines the film stability with respect to the film thickness h, molecular weight M, and fly height of the slider hf. The model incorporates non-dispersive interaction between an endgroup of lubricant and carbon overcoat surface so that it is capable of a Fomblin Zdol type lubricant. The Zdol lubricant film exhibits autophobic dewetting, which is initiated by the functional endgroups localizing at substrate interface and by the low surface energy in its buckbone. In such a system, the surface free energy of the film must be properly described as a function of thickness to incorporate effects due to the characteristic nanostructure near the surface. [C508]

"Highly ordered FePd and FePt nanostructures"

In the present study we show two variations of the bottom-up approach. First our correlated structural and magnetic properties studies on epitaxial FePd films grown on (001) MgO will show that this particular system does exhibit perpendicular magnetic anisotropy and it is also nano-structured due to 3-dimensional growth mode on the chosen substrate. We also note here that the highly-ordered nanostructures embedded in the chemically disordered alloy film are magnetically coupled. We found that capping the films with a thin MgO layer significantly lowers interparticle coupling. For the FePt system we have used ion-implantation of Fe ions on epitaxial Pt films followed by rapid thermal treatments. We have achieved controlled nano-patterning, large perpendicular magnetic anisotropy and decoupled highly ordered nano-structures. We present our correlated structural (XRD, AFM, TEM) and magnetic (MFM, Kerr magnetometry) characterizations on the two systems studied. Our observations are useful to further understand magnetic anisotropy properties at the nano-scale for new media applications. [C509]

"Micromagnetic simulation of magnetic triangularly shaped nanoelement formed by nanosphere lithography"

In this paper, we adopt micromagnetic simulation based minimizing the energy to study the ground state of TSN formed by NSL, and to understand the reversal magnetization mechanism of this nanostructures.The ground state and magnetization process of the triangularly shaped nanoelements formed by monolayer nanosphere lithography were simulated by micromagnetic formalism. The simulation showed that TSN had four ground states dependent on the thickness and lateral size of the nanoelement. [C510]

"Nanostructure fabrication using nanosphere lithography for photonics devices"

We use the self-assembled polystyrene nanosphere monolayer pattern to replace photoresist mask for the fabrication of 2D nanostructures on various substrates. The optical properties of these artificial structures are measured and compared with theoretical calculation. [C511]

"FePt magnetic material synthesis by electrochemical methods"

FePt alloy Is an important hard magnetic material with magnetic anisotropy constant as high as 6.6X107 ergs/cm3. The material has attracted much attention these years due to its good magnetic properties. The main route to get it is based on the solution phase synthesis. The material can also be obtained by electrodeposition method as reported here. In the synthesis process, the electrochemical methods were applied, and nanostructured FePt material was obtained. [C512]

"Nanomaterial fabrication by Ru atomic layer deposition on anodic aluminum oxide nanotemplate"

Ru Atomic layer deposition (ALD) and anodic aluminum oxide (AAO) process were studied for fabrication of one dimensional metallic nanostructure. Low resistivity and very pure ruthenium thin films were deposited from

bis(ethylcyclopentadienyl)ruthenium [Ru(EtCp)2] by thermal atomic layer deposition (ALD) using oxygen (O2) gas and plasma-enhanced ALD (PE-ALD) using ammonia (NH3) plasma. In addition, regularly ordered porous anodic aluminum oxide nanotemplates were fabricated on aluminum plate and Al film by multistep-step anodization method. The process conditions for Ru ALD process to fabricate metallic nanostructure by filling the nanotemplates were investigated. [C513]

"Short course II-B Bio-nanoelectronics. Enabling a new paradigm of information technology: acquiring info and executing on info"

Information technology has been a great success, but also a narrow one -it has marched along the narrow path of processing and transmitting information. While there is still more room to continue the march along this same path, there appears to be much greater rooms in the space to the left -acquiring information, to the right - executing on information, and on the "inside" -acquiring and executing on information inside human body. This new paradigm of information technology can be well served by advances in bio-nano electronics. By way of presenting specific examples, this short course introduces a few basic concepts, methods and recent advances on three fronts of bio-nano electronics: (a) DNA directed self-assembly and growth of nanostructures (b) Real-time, scalable, reconfigurable, and direct read-out of bio-molecular signals (by nanoelectronic circuitry via programmable DNA wiring and addressing) (c) Intracellular probing, delivery, and exploration by nano-electrodes. [C514]

"New Opto-Plasmonic Tweezers for Manipulation and Rotation of Biological Cells-Design and Fabrication"

Opto-Plasmonic Tweezers are proposed as a new optical manipulator and rotator for biological cells. The approach utilizes polarized light to excite localized surface plasmon resonance (LSPR) on an array of Au nanostructure. Large dielectrophoretic trapping force is expected to be induced by the highly non-uniform scattering field from the resonant oscillating dipoles. Fine orientation control of the cells can be realized by tuning the polarization state of the input light [C515]

"Imaging Cross-section of DNA electrophoresis in a microfabricated glass device with CLSM"

In this paper, confocal laser scanning microscopy (CLSM) is used to detect and analyze DNA electrophoretic migration in a microchannel filled with in-situ polymerized cross-linked polyacrylamide. DNA distribution at the cross-section of the microchannel is observed to vary only slightly with the tested gel concentrations and the DNA sizes. However, in comparing with DNA electrophoresis using linear polymer solution (LPA), significant differences are observed in the distribution of DNA molecules on the observation plane using a cross-linked matrix (UV-polymerized polyacrylamide). Instead of a uniform signal boost upon the pass of one DNA band in linear polymer matrix, the electrophoretic process with cross-linked polyacrylamide presents a cross-section image with most DNA molecules aggregate near the vertical center of the microchannel during migration. This observation suggests an inhomogeneous nanostructure of in-situ polymerized cross-linked polyacrylamide in a microfabricated glass channel, consistent with SEM results. However, the phenomenon of DNA bands tending to focus in the vertical center along z-axis has not been previously reported. We also conclude from these observations that geometries containing fewer dead corners are desirable to minimize residual DNA in the microchannel [C516]

"Nanomaterials based optical and electrochemical biosensors"

The interaction of nanotechnology and biomedical sciences opens the possibility for a wide variety of biological research topics and medical uses at the molecular and cellular level. The fundamental features of biological systems such as self-assembly, self-replication, and highly specific recognition open new routes to extend solid-state top-down fabrication nanotechnologies. For example, nanomaterials like carbon nanotube, metal nanoparticle and quantum dots contribute to improve performance of biosensors and biochips. The application of nanotechnology in biomedical sciences will provide information with unprecedented precision and sensitivity, which will not only provide much deeper understanding of biosystems but also lead to the development of new revolutionary modalities of biomolecular manufacturing, early diagnostics, medical treatment, and disease prevention beyond the cellular level to that of DNA and individual proteins, the building blocks of the life process. Nanobiotechnology surely open new reliable products in the medical healthcare and food safety and environmental protection/energy conversion system. In my talk,, nanostructure based optical biosensors and electrochemical biosensors using nanomaterilas will be focused as follows. [C517]

"Vertically oriented TiO2 nanotube arrays prepared by anodic oxidation"

Vertically oriented TiO2nanotube arrays transformed from Ti thin film on silicon substrates are very attractive due to their potential for nanostructure integration on silicon [1]. We fabricated the vertically oriented TiO2nanotube arrays using Ti thin film anodization under various processing conditions. To obtain the optimum condition for the vertically oriented TiO2nanotube arrays, the various anodization voltages and temperatures were investigated in aqueous solutions mixed with highly corrosive Na2SO4/NaF/citric acid and NH4F in glycerol (1,2,3-propanetriol). In case of a good quality Ti thin film deposited at 500degC, vertically oriented TiO2nanotube arrays were formed in NH4F in glycerol (1,2,3-propanetriol) at 20degC. FE-SEM images of vertically oriented and highly ordered TiO2nanotube arrays were shown in Fig. 1. The pore diameter and center to center spacing of nanotube arrays were -50 nm and -100 nm, respectively. However, in case of Ti thin film deposited at room temperature, very thin TiO2layer of-70 nm with a worm-like structure was grown on the porous layer [2]. Fig. 2 shows a typical current density transient curve recorded during anodization under a constant voltage for self-organized pore formation. The pore formation behavior of anodic titanium oxide was similar to that of porous anodic alumina (PAA) [3]. And the dependences of pore morphology and pore formation rate on process parameters were evaluated in Fig 3. The porous anodic oxide layer grown on titanium by electrochemical anodization was studied and compared to the mechanism governing the formation of porous alumina. X-ray diffraction patterns revealed that as-anodized titania nanotube arrays with amorphous phase were crystallized to anatase phase by annealing at 500degC. The fabrication of nanoporous anatase titania with well-defined cylindrical pores and adjustable pore spacing has been attractin- g considerable fundamental and technological interests because of the important applications in sensing and detection, separation, electronics, optoelectronics and as host materials for various nanostructures [4, 5]. The vertically oriented and highly ordered TiO2nanotube arrays have applications to dye-sensitized solar cell and bio-sensing materials. [C518]

"Optical parametric oscillation in a vertical triple microcavity"

We report the first realization of a monolithic vertical-cavity, surface emitting micro optical parametric conversion nanostructure, triply resonant with the parametric frequencies, allowing parametric oscillation or amplification with a very low pump power threshold. [C519]

"Effect of charge storage in silicon nanocrystals on needle-like nano-structure for non-volatile memory"

In this work, metal-Insulator-semiconductor (MIS) devices with silicon nitride film as insulator layer have been fabricated on needle-like nano-structures, which can be applicable to non-volatile memory device with increased charge storage capacity over planar structures. We have already reported surface morphologies of needle-like structures and existence of nanocrystals in silicon nitride layer using photoluminescence (PL). In this paper, memory effects are demonstrated by electronic properties of MIS devices with substrate of nano structure. Window sizes of capacitance-voltage (C-V) characteristics in MIS devices on substrates of nano-structure are formed to increase compared to that in MIS device fabricated on planar structure. Therefore, a non-volatile memory device with increased charge storage capacity over planar structure can be realized with the nano-structure. [C520]

"III-V semiconductor nanoelectronics for post si era"

Scaling limit of Si CMOS technology and advent of "Ubiquitous Network Era" seem to open up new horizon for III-V nanoelectronics with much wider application areas than today. Here, its future challenges and key issues are discussed. [C521]

"Bandgap modulation of single crystalline CdS x Se1-x ternary alloy nanowires"

Nanowires of CdSxSe1-x(0<x<1) ternary alloy have been synthesized by a simple pulsed laser ablation process in a hot-wall type chamber on an Au-coated Si substrate. The complete solid solution of CdS and CdSe was confirmed in the entire compositional range and the energy bandgap could be controlled from 1.74 eV to 2.45 eV as a function of sulfur content. The CdSxSe1-xnanowires in this study exhibits better optical properties and perfect crystallinity compared to those of bulk or thin films. [C522]

"Nano-Fabricated Mesoporous Pt electrode on Silicon for CMOS Integrated Electrochemical Sensor Applications"

Most of the biosensors are based on the enzymatic electrochemical analysis and are disposable due to the use of the enzymes that are living creatures. Thus, these are limited to the in-vivo and handheld continuous monitoring sensor system applications. In this paper, a nano-hole (mesoporous) arrayed Pt electrode is investigated for developing the non-disposable electrochemical sensors without using any enzymes, which are

also integrated with silicon CMOS read out circuitry. In comparison of the mesoporous Pt electrode and the plane (non-treated) Pt electrode, the current responses of mesoporous Pt electrode and the plane Pt electrode are approximately 4.62 muA/mm2and 9.91 nA/mm2respectively in 10 mM glucose solution. The fabricated mesoporous Pt electrode was hardly influenced by the interrupt material as the ascorbic acid. This result shows the nano-fabricated mesoporous Pt electrode is promising for CMOS integrated non-disposable sensor applications [C523]

"The Micro Mass Spectrometer with A Carbon Nano Structure Ion Source"

This paper reports the fabrication and experiment of a micro time of flight (TOF) mass spectrometer adopting a new ion generation method using a carbon nanostructure. The device is composed of an ion source and an ion separator. The ion source generates electrons by the field emission method. Carbon nanostructure has good field emission property. The emitted electrons collide with sample molecules and ionize the sample molecules. These ions are accelerated by separator. The current output signal is generated when the ions reach the ion detector in the order of mass size. The size of the assembled micro TOF mass spectrometer is 11 times 11 times 1 mm3. The experiment is performed in a vacuum chamber. The sample gas is introduced to the chamber and suitable voltages are applied to separation electrodes for the ion acceleration. Then we observe the current signal from the ion detector. The experimental result verifies the feasibility of the ion source and the ion separator included in the fabricated micro mass spectrometer [C524]

"Optoelectric Characteristics of Porous Silicon Using a Conducting Polymer"

The simple porous silicon-based devices producing stable electroluminescence (EL) by the deposition of a poly-4-dicyanomethylene-4H-cyclopenta dithiophene monolayer (PCDM) into the nanostructure is reported. The structure of these devices is Au/PCDM/porous silicon/Si/Al. The EL emission is bright, visible by the naked eye under normal daylight and broad in wavelength covering the whole visible range with a peak at 620 nm. The emission area of the devices is 1 cm2. The EL starting voltage is in the range of 14-30 V and the current is around 300 mA. The time stability is good for all the devices tested. After exposure to the air for more than three months, the devices show nearly the same emission intensity without increase of external power supplied. The I-V curves are fitted to a Schottky barrier model with a barrier height of 0.8 eV. The orange photoluminescence band from the porous silicon is due to recombination in the silicon quantum structures both before and after coating with PCDM [C525]

"Morphology Control in the Synthesis of Iron Oxide and Oxyhydroxide Nanoparticles"

Precise control of size and shape are important goals in the synthesis of functional nanoparticles, as these factors play a key role in determining properties. Morphology control in the formation of iron oxide and oxyhydroxide nanoparticles can be approached in a number of ways, and this presentation outlines some of the approaches that have been explored in recent work at the Nanochemistry Research Institute. In some cases, control of nanostructure and particle aggregation characteristics can be achieved by simple control of supersaturation conditions, while in others, crystal morphology is modified by the face-selective action of organic additives. For example, the effect of polyphosponates on hematite nanoparticle morphology has been studied under both acidic and basic conditions and the experimental results interpreted in conjunction with molecular modelling studies of the crystal surface/additive interaction. Crystal growth mechanisms in the formation of iron oxide and oxyhydroxide nanoparticles have also been studied, providing examples of some novel, tube-like morphologies and evidence for growth of larger assemblies by oriented aggregation of nanoparticulate sub-units [C526]

"Preparation and Applications of Nanocrystalline Silicon Devices"

Recent progress in the fabrication technology of silicon nanostructures has made possible observations of novel electrical and optical properties of silicon quantum dots, such as single electron tunneling, ballistic transport, visible photoluminescence and electron emission. Electron transport and photonic properties of silicon nanocrystals prepared by plasma processes are described with particular emphasis on fabrication of monodispersed silicon nanocrystals, high-density assembly of silicon quantum dots, silicon nanodot memory, NEMS devices, and silicon photonic devices [C527]

"Batch Fabrication of Self-assembled Nickel-Iron Nanowires by Electrodeposition"

Lack of batch-compatible fabrication techniques can be considered as the most important challenge in the integration of nanostructures with microelectromechanical systems (MEMS). A solution to the micro-nano integration problem is offered by introducing a batch-compatible nanowire fabrication technique based on basic lithographic techniques and guided self-assembly. The basic principle is obtaining cracks at predetermined

locations in a sacrificial SiO2layer on Si and filling these cracks with a suitable metal by electrodeposition. The technique is demonstrated by using nickel-iron as the deposition material and verifying the magnetic behavior of resulting nanowires [C528]

"Silicon Nanostructures Formed by Self-organizing Au Nanoparticle Film"

Silicon nanostructures were fabricated by a natural lithography technique, with sizes far beyond the limit of conventional, by a self-organizing gold colloidal particle monolayer as an etch mask. The silicon nanostructures with high density and uniformity in height and shape were obtained using reactive ion etching (RIE). The uniform spatial distribution of the Si nanostructures can also be obtained. The resulting nanostructures were investigated by scanning electron microscopy. This method can be applied to patterning a wide variety of thin film materials in to dot arrays [C529]

"A New Method to Prepare Ordered Silver Nanoparticle Arrays"

Poly (styrene-b-butadiene-b-styrene) (SBS) triblock copolymer templates which present in-plane cylinder pattern have been prepared by solvent-induced order-disorder phase transition method. Then silver clusters have been deposited onto the SBS copolymer templates by low energy clusters beam deposition (LECBD) apparatus. The characterization of samples by AFM with tapping-mode has shown that silver nanoparticles form ordered linear arrays, the interparticle distance of the same linear array is comparable to the particle size. Optical absorption spectra reveal that the surface plasmon resonance (SPR) of silver nanoparticles linear arrays occurs at 500 nm. It is mainly due to electrodynamic interactions between silver nanoclusters. The surface-enhanced Raman spectroscopy (SERS) spectrum shows the electric field enhancement that occurs in the vicinity of interacting silver nanoparticles. Hence the assembly of metal-copolymer nanostructure provides a promising route to achieve well ordered nanostructures [C530]

"Enhancement of Light Extraction Efficiency in OLED with Periodic Nano-Structure"

To improve the light-extraction-efficiency of organic light emitting diode (OLED), we introduced novel photonic crystal slab (PCS) structures with Taper unit cells into the interface of ITO layer and glass substrate. By optimizing the geometric parameters, we proved that the PCS with triangular lattice of Taper cells was more effective in reducing the energy of guided wave trapped in OLED than the traditional PCS structures. Light-extraction-efficiency of OLED based on this PCS increased by 95.26%. Physical mechanisms of light- extraction-efficiency enhancement in these structures are further discussed. [C531]

"The Fabrication of Nano Structures on Wafer Surface by using Nano Island Lithography"

There are serial structuring methods invented or used for the fabrication of nano structures. However, there is an urgent need for innovative processing technologies, including hybrid methods across multiple energetic domains, and three-dimensional imaging and fabrication technologies such as ultrasonics. This paper shows a novel method of nano island lithography to shape hemispherically islands of cesium chloride with nano size. Nano island lithography was invented by Prof. Mino Green in Imperial College as a synthetic fabricating method (bottom-up). The method is the exposure of the CsCl thin film to water vapor for growth of CsCl islands (also called dots or hemispheres). Growth rate of CsCl islands is dominated by the kinetics of dissolution and deposition at the solid/solution boundary, rather than by inter island diffusion. The CsCl islands are translated to wafer or other material surface by RIE and lift-off technologies which are transformative (top-down) fabrication. And more, the island lithography can combine with UV lithography to create micro and nano scale hierarchical structures which induce super-hydrophobic surfaces with large CA and small alpha. [C532]

"Fabrication of Three Dimensional Micro Devices by Means of Two Photon Photopolymerization"

With the rapid progress of ultra short laser technology, two photon photopolymerization(TTP) has been introduced into the domain of microfabrication. Its characterization and process are described in this paper as well as its experimental system. Through the relevant experiments, we optimized the spatial resolution of this method. Under the fine focusing, we obtain the minimum line width of 0.65 mum, which has broken the diffraction limit. Finally, we have presented some microstructures fabricated by this technique, which illustrate its practicability in fabricating micro and nanostructures efficiently. [C533]

"Relationship of Titania Nanotube Binding Energies and Raman Spectra"

Novel nanostructured titania nanotubes and hydrogen titanate nanoribbons were synthesised using hydrothermal treatment of Degussa P25. The nanostructure types formed were monitored as a function of the hydrothermal conditions. Changes in structure was evaluated using X-ray photoelectron spectroscopy (XPS), powder X-ray

diffraction (XRD), transmission electron microscopy (TEM) and Raman spectroscopy. X-ray photoelectron spectroscopy (XPS) of Ti(2p) and O(1s) binding energies in titania nanotubes were measured and a systematic trend in the XPS binding energies was observed. This indicated a strengthening of the Ti-O bond occurred as the material phase changed from titania nanotube to the titanate ribbon form. The changes in binding energies for both the Ti and O XPS peaks were consistent with changes observed in the Raman spectra of nanostructured titania. [C534]

"Nanostructure Dependence of Conductive Polymer Chemical Sensors"

It is shown that the resistive sensing properties of conductive polymers are highly dependent on the material nanostructure. The sensing properties of regioregular poly(3-hexylthiophene) (P3HT) polymer thin films with porous nanofibrile structure, dense nanofibrile structure and nano-granular structure show very different conductance changes, in terms of both response amplitude and sign, upon exposure to various VOC vapors. This implies that multiple sensing mechanisms, such as both grain boundary and intra-grain effects, exist and the dominant sensing mechanism can vary with different material nanostructures. Possible mechanisms for these effects, and their correlation with observed material nanostructures, are also discussed. [C535]

"Capacitive Humidity Sensing using Carbon Nanotube Enabled Capillary Condensation"

This electronic document is a "live" A capacitive humidity sensor, fabricated by depositing multi-wall carbon nanotubes (MWCNTs) on one of the stainless steel substrates, is presented for moisture detection at room temperature. When compared to a sensor without CNTs, CNT-enhanced sensor has a capacitance response of 60-200% more when the humidity is under 70% relative humidity (RH), and 300%-3000% more if RH level goes over 70%. The detection and recovery response times are on the order of seconds. The performance is comparable to a commercial sensor from Honeywell that is used as a benchmark throughout the experiments. Our results demonstrate that nano-materials like MWCNTs, can naturally form porous nano-structures, which can potentially realize a miniature capacitive humidity sensor with a higher sensing resolution. The gain in performance is attributed to capillary condensation effect. The capillary condensation effect, that is facilitated by the porous nanostructures of random aligned MWCNTs, is discussed in this paper template. The various components of your paper [title, text, heads, etc.] are already defined on the style sheet, as illustrated by the portions given in this document. [C536]

"VMOS, UMOS technology simulation"

VMOS, UMOS ("V"-groove-metal-oxide-silicon) transistors drain and gate are formed in the groove of "V" or "U" form. Expanding channel area, therefore VMOS and UMOS structures may use in the power chips. Using VMOS, UMOS is saving 40% free space than using NMOS technology. Nanostructures dimensions are very small, so it is important to keep pn junction in a right depth, in the all semiconductor manufacturing technological process. Analyzing influence to forming structure of each technological operation is used mathematical simulation program SUPREM IV. VMOS and UMOS technological operation was simulated in micro and nano level [C537]

"Microwave resonances in nanogranular (Fe0.7Co0.3)71B22Ni7 films"

A detailed characterization and analysis of the microwave properties of a set of nanogranular (Fe0.7Co0.3)71B22Ni7films under an applied magnetic dc field ranging from 0 to 45 kA/m is presented. A full microwave characterization of the films is performed up to 20 GHz using a vector network analyzer (VNA) connected to a matched microstripline or coplanar waveguide, loaded with the films. The evolution of the FMR frequencies and line-widths is derived as a function of the field applied along the easy axis (in-plane) and discussed with reference to the film nanostructure and the combination of anisotropy, demagnetizing and applied fields. [C538]

"A New Efficient Method in Calculation of the Ground State and Few Excited States of Hubbard Chain Nanostructures"

A new method for calculation of the ground state of the Hubbard Hamiltonian is presented. With the same procedure by using induction and computer simulation we developed this method to higher atom and electron number. [C539]

"Carbon Monoxide Gas Sensor Based on Titanium Dioxide Nanocrystalline with a Langasite Substrate"

Titanium dioxide (TiO2) and gold doped TiO2(Au-TiO2) thin films on langasite (LGS) substrates were employed

for carbon monoxide (CO) sensing. These two types of sensors have interdigital electrodes with Ti, Ni and Au metallization film. Thin films of TiO2were deposited using the radio frequency (RF) magnetron sputtering method. Both TiO2and Au-TiO2based gas sensors were exposed to low concentrations of CO gas in synthetic air at a temperature range between 230degC and 320degC and their electrical conductivity were measured. It has been observed that the device sensitivity is much greater for the Au-TiO2based gas sensor. The response time of the sensor is shorter than that of commercial conductometric CO sensors. [C540]

"Theory of Cohesive Forces in Layered and Striated Nanostructures: Some Surprises"

A discussion is given of the surprising form of the asymptotic van der Waals (dispersion) force recently predicted to occur between parallel metallic nanotubes or wires, and also between graphene planes and various structures. [C541]

"Characterization of turbostratic carbons synthesized by catalytic decomposition of acetylene"

Turbostratic mesoporous carbons were synthesized by catalytic decomposition of acetylene over Cu/MgO or Cu/Al2O3catalysts. The carbon samples were characterized by X-ray diffraction (XRD), nitrogen adsorption, transmission electron microscopy (TEM) and thermo gravimetric analyser (TGA). The decomposition of temperature was found having crucial effect on the micro structure and reactivity of carbon samples. Increase of decomposition temperature leads to the decrease of the surface area and growth of carbon crystallite volume (Vnano), which make the chemical reactivity of carbons reduced. It was found that Vnanois a useful parameter to describe the effect of the crystalline structure on the reactivity of turbostratic carbons in oxygen-carbon reaction. [C542]

"Field-Emission Diode and Triode Structures Using Self-Assembled Silicon Nanostructure Cathodes"

Field emission displays (FEDs) are one of the various technologies being developed for the flat-panel display market. Much recent work has centred on carbon-nanotube-patterned cathodes, however, and alternative technology that is compatible with conventional silicon CMOS processes would be desirable. Self-assembled silicon nanostructures are a possible alternative. Processes for forming diodes and triodes incorporating these nanostructures, along with electrical characterisation data, are presented in this paper. [C543]

"Multipolar Photonic Interactions for Interconnections and Logical Operations in Nanostructure Networks"

Multipolar interactions involving real and virtual photons are compared, and suggested as the principle of intra-device, inter-device, and inter-chip interconnections and logical operations, with the device concepts for solid state nano-networks and a quantum computer [C544]

"A microfluidic flow sensor for measuring cell adhesion"

We present a simple, biomarker-free microfluidic device for separating cancer cells from a mixed solution of normal and cancer cells by difference in adhesion force. A polydimethylsiloxane (PDMS) microfluidic chip was fabricated onto glass substrate using standard soft lithography. Three types of polyurethane acrylate (PUA) nanostructure (50 nm pillar, 50 nm perpendicular groove, 50 nm horizontal groove with respect to the direction of flow) were included inside the microfluidic channel by UV-assisted capillary molding. For cell types, MCF7 (breast cancer cell line) and MCF10A (breast normal cell line) were used. To find the optimum condition for separation, each cell line was injected into the microfluidic device and cultured for 1 h, 2 h, and 3 h, respectively, followed by cell detachment by flow of medium solution with increasing flow rate. The adhesion force of MCF10A was stronger than that of MCF7. MCF10A cells cultured onto the nanopatterned surface were more spread than those cultured onto the glass surface. Furthermore, the presence of nanopatterns increased the ratio of adhesion force of normal and cancer cells and thus and the separation efficiency. The optimum culture condition was 2 h onto the nanopattern and flow rate was ~ 300 mul/min. [C545]

"Laser assisted imprint of silicon nanostructure with good crystal quality"

Excimer laser assisted imprint technology is implemented to create nanostructure on silicon substrate. Patterns with 25-nm feature sizes are successfully fabricated on quartz mold using electron beam lithography for nano-imprint. Transfer of nano-meter features to silicon is experimented. Parameters for optimal imprint are investigated. With a peak light intensity of 1 2 J/cm2, imprint pressure of 10 100 g/cm2, and high vacuum at 106torr, nano-imprint has very good results. The carrier lifetimes before and after laser-assisted imprint are studied and discovered to vary from 1818 μs to 640 μs. This small damage of Si substrate is attributed to

recrystallization of silicon. [C546]

"Development of nano-dissection chip for analysis of chromosome nanostructure and its function"

The dissection of chromosomes followed by extraction of specific DNA fragments constitutes a topic of high interest, especially for cytogenetic studies in the post genome era. The dissected chromosomes can be used in various conventional applications, including establishing probes for fluorescence in situ hybridization (FISH), the generation of chromosome band-specific libraries and physical mapping for cytogenetic analysis. For this purpose, several reports using micro- and nano-dissection methods by micromanipulators have been published. In the present study, we developed a functional chromosome nano-dissection chip that can dissect various chromosomes in one-chip by using the pattern chip with nano-scale porous anodic alumina. The porous anodic alumina, that makes use of self-organized nanoarray materials as a template for the pattern chip, has a highly oriented porous structure with uniform and nearly parallel pores that can be organized in an almost precise close-packed hexagonal structure. The most characteristic feature of this material has been emphasized with the extremely high aspect ratio of their channels that is difficult to achieve with conventional lithographic techniques. This chromosome nano-dissection chip can dissect directly a specific chromosome into a nano-scale pore without AFM dissection process. Thus, we expect that are chromosome nanoarray chip is very suitable for arraying chromosome fragments without the recovery process with the possibility of direct immobilization of chromosome fragments into nano-scale pore of this chip. [C547]

"Fabrication of silicon nanostructures with various sidewall profiles and sharp tips"

We report a simple but effective method to fabricate high-aspect-ratio silicon nanostructures with 230 nm pitch (i.e., period) using interference lithography followed by deep reactive ion etching (DRIE). Sidewall profiles of nanograting and nanopost patterns are controlled through etching parameters of DRIE. We also show that tips with a pointed and re-entrant profile can be created. The tip can further be sharpened by thermal oxidation and subsequent wet etching of the oxide. Nanostructures with various sidewall profiles and sharp tips open new application possibilities not only in electronics but also in other engineering and general areas. [C548]

"Nano-net fabrication on the glass capillary by focused-ion-beam chemical-vapor-deposition"

Nano-tools are very important for the subcellular operation and analysis in the bio-experiments. For giving the high-performance to nano-tool, we think that it is necessary to make tools the three-dimensional (3D) nano-structure devices. Therefore, we have performed the 3D nano-tools fabrication by using focused-ion-beam chemical-vapor-deposition (FIB-CVD). This time, a nano-net as a novel 3D nano-tool was fabricated by using FIB-CVD. And we succeeded in scooping the polystyrene micro-sphere with a diameter of 2.0 μm by using a nano-net. [C549]

""Semiconductor nanostructure devices: recent advances and their potentials for transducers applications""

We discuss the current state of quantum well infrared detectors (QWIP) and related devices to clarify potentials of QW in the field of transducers. With the progress of nanotechnology, a number of new devices making use of quantum wires (QWR) and quantum dots (QD) have been realized; they include single electron transistors, QD charge storage devices, interband and intersubband QD photodetectors, QD-based single photon detectors and emitters, and QD-based fluorescent markers. We describe the current state of these devices and discuss their potential. We discuss also the self-organized growth and novel properties of InAs and GaSb quantum ring structures. [C550]

"3D microscopy provides the first deep view"

Coherent X-ray diffraction microscopy has recently been developed to image nanostructures and biological systems in two and three dimensions. A highest resolution of 7 nm has been achieved. We anticipate this 3D imaging technique will find broad applications in the burgeoning field of nanoscience and technology. [C551]

"A contour-lithography method for rapid and precise deep-etched nano-MEMS structure fabrication"

This paper proposes a high throughput and nanometrically-precise fabrication method of nano-and millimetric structures on the same wafer. Recent advancement of deep reactive ion etching (DRIE), with electron beam (EB) lithography provides us with nano-HARMS for a variety of applications. However in general, DRIE condition optimized for nanometric feature is incompatible with large-scale areas, because it is highly influenced by the aspect ratio and the absolute size. This paper proposes to solve this critical problem by the two-step etching

method: (1) etching of nanostructure plus contour of large area, and (2) the rest. Moreover, high-throughput EB lithography is assured by writing only the contour, while keeping nanometer-order precision by grace of the simultaneous lithography of contour and nanostructure. The method proved its capability by successful fabrication of 1 μm-scale optical filters coexisting with millimeter scale (0.75 mm2) trenches. [C552]

"A drift-diffusion subband model for the double-gate MOSFET"

A self-consistent model for charged particles, accounting for quantum confinement, diffusive transport and electrostatic interaction is considered. In this coupled quantum-classical system, the coupling occurs in the momentum variable: the electrons are like point particles in the direction parallel to the gas (classical transport) while they behave like waves in the transversal direction (quantum description). Numerical implementation of this model provides a simulation of the transport of charge carriers in a quasi bidimensional electron gas confined in a nanostructure. [C553]

"NMR investigation of the same charged gelling biosystems for drug capsulation"

It is proposed a series of new NMR relaxometry, diffusometry, spectroscopy techniques for the development of drug capsulation technology. On the basis of this NMR study a new capsulation system, the same charged gelling biosystem, was proposed. The nanostructure properties of the gelling bio-system including the phase diagram, nanopore and aggregate radii, drug release rate, system stability were measured using a new diffusion-specific probe, the same charged surfactant micelles, and theoretical approach of diffusion problem with complex variable representation. Drug release rate from the bio-capsule was determined using new NMR localization method without the application of the magnetic field gradients. The stability of the capsulating nanobiosystems was controlled by NMR relaxometry of water protons and parallely by the DSC and CD methods. The results show high sensitivity of the NMR methods to study homogeneous hydrogels with low volume fraction, an agreement with the X-ray diffraction data and promising perspectives for the use of the same charged gelling biosystems as high drug capacity, rate-controlled, bioadhesive media in pharmacology. [C554]

"2005 International Conference on Physics and Control (IEEE Cat. No. 05EX1099)"

{no data available} [C555]

"SOI-based photonic crystals"

Recent progresses of SOI-based 2D photonic crystals have been reviewed. It has been shown that line and point defects in photonic crystals well manipulate photons, and photonic-nanostructure devices can be indeed realized. The progresses of nanocavities with ultrahigh Q factor of 6000000 have also been described. The realization of such ultrahigh Q nanocavities should accelerate developments not only in the field of photonics but also in various other fields including quantum communication and computing, bio and accurate environment monitors. [C556]

"Nanostructural characterization of carbon nanofibers for on-chip interconnect applications with scanning transmission electron microscopy"

Recent studies in the nanostructural characterization for on-chip interconnect using carbon nanofibers (CNFs) is presented. In this paper, we compare the resistance and structure between Ni and Pd-catalyzed CNFs, which show differing electrical properties. These samples are characterized with scanning transmission electron microscopy (STEM). Our analysis reveals the nanostructure of CNFs in detail. We also discuss the growth mechanisms of CNFs and the choice of catalyst materials used for interconnects development. [C557]

"Low temperature growth of crystalline AlQ3 nanowires from amorphous nanoparticles"

A new method to form 1D nanostructure of tris-(8-hydroxyquinoline) aluminum (AlQ3) has been demonstrated. This method is a one-step heating process at low temperatures to transform AlQ3amorphous nanoparticles into crystalline nanowires. AlQ3exhibits a highly electroluminescent efficiency and an anisotropic crystallographic nature. Appropriate heating provides a suitable condition for the molecules easily adopting a favorable configuration for the 1D growth. From the XRD analysis, α phase of AlQ3is formed after heating. Higher intensity of photoluminescence (PL) and a blue shift after heating are also illustrated. [C558]

"Organic nanofiber of copper phthalocyanine"

In this study, we successfully fabricate one-dimensional (1D) nanostructure of Copper Phthalocyanine (CuPc), whose bulk form are normally used as a blue pigment and a hole transfer layer for the organic light emitting

diode. With the vacuum evaporation method, the morphology of CuPc deposited at room temperature exhibits smooth surface, while for growth at higher temperature, the film showed a tendency to island growth (dewetting). These CuPc nanofibers also possessed field emission characteristic, which provide an opportunity to evaluate the feasibility for organic molecular fibers to play a role as electron emitters. [C559]

"Nano-structure enhanced organic light emitting diodes made with CdSe(ZnS) quantum dots and a semiconducting polymer"

In this study, we report experimental results on the bilayer light emitting diodes made with organic capped CdSe(ZnS) core/shell type semiconductor nanocrystals and an electroluminescent semiconducting polymer, poly[2-phenyl-3-(9,9-dihexyl-fluoren-2-yl)phenylene vinylene]-co-[5-methoxy-2-((2'-ethylhexyl)oxy)phenylenevinylene]. The device with the configuration ITO/PEDOT/CdSe(ZnS) and polymer blend/Ca/Al was fabricated. The pure polymer device emits yellow light with maximum brightness of 3949 cd/m2and maximum external quantum efficiency of 0.27 cd/a at 10 V, after blending with the CdSe(ZnS) quantum dots, the pled device shows much high brightness and external quantum efficiency and lower driving voltage. The maximum brightness is as high as 8192 cd/m2with maximum external quantum efficiency of 1.27 cd/a at 7 V. [C560]

"Magnetic and ordering studies of sputtering nanostructured Fe50 Ni50 films"

A nanostructured Fe50Ni50alloy is synthesized by DC magnetron sputtering. The magnetic and structural properties and the disorder-order transformation of the film are investigated. It is found that the increase of saturation magnetization, coercivity and the decrease of resistance after 280°C/1 week annealing indicate that ordered L10Fe50Ni50alloy had been synthetically produced by obtaining the nanostructure and by thermal annealing. [C561]

"Magnetic nanoparticles assembly on peptide nanotube"

In this report a novel nanostructured magnetic assembly that consists of magnetic nanoparticles coated on peptide nanotubes (MPN) is presented. Specifically, MPN samples that consist of nanoparticles of different magnetic materials including bacteria-produced magnetite (Fe3O4) and nickel were examined. The bacterial magnetite nanoparticles can be coated inside or outside the peptide nanotubes depending on the synthesis condition. The structure and morphology of MPNs were examined by transmission electron microscopy (TEM) and the magnetic properties were characterized using a vibrating sample magnetometer (VSM). Results show that the assembled morphology and resulting magnetic behavior of Fe3O4nanoparticles coated on the nanotubes depend on the synthesis condition and indeed vary with the concentration of the nanoparticles in the solution. The magnetic behavior clearly reflects the geometry of the magnetic particles. The magnetic properties of nickel nanoparticles mineralized and coated onto peptide nanotubes are governed by the particle size and crystallinity, controlled by the pH during the synthesis. [C562]

"Application for electric resistance element of granular films"

Thin film electric resistance elements were presented, utilizing granular films of CoAlO. Electrical properties of the films show dependence with metal content and granular nanostructure. The values of α and β in the optimum metal content were as low as those of conventional metal film resistances. Sheet resistance values were observed to be much higher than those of conventional metal film resistances. Therefore, granular films are useful for application to thin film resistance for purpose of minimizing the resistance element. [C563]

"Selective MOCVD growth of Fe3 O4 epitaxial thin films for nanostructure"

Fe3O4thin films are grown using metalorganic chemical vapor deposition (MOCVD) on MgO, sapphires and quartz glass. It is observed that the substrate temperature, where the film growth of Fe3O4occurs, is much higher for MgO and sapphire than for the substrates containing transition metal such as NiO. This indicates that the thin films can be selectively grown at a temperature only on the area modified by a thin layer having higher catalytic activity for oxygen adsorption than the other. [C564]

"Magnetic nanostructure hysteresis loop calculation for modified thin film multi-layer by ion irradiation"

The fluence of ion irradiation on paramagnetic, polycrystalline thin films affects both anisotropy and spontaneous magnetization Ms . The dependence of coercivity and initial susceptibility on Msis predicted by a hysteresis model considering the balance of energy with good qualitative agreement. The calculated bit stability, determined by the anisotropy constant, may be promising for future data storage applications [C565]

"Enhancement of spin current by modifying the chemical potential profile in the nanopillar"

In this paper, a formalism calculating the spatial (3D) distribution of the electrical chemical potential inside a nanostructure consisting of arbitrary ferromagnetic (FM) and nonmagnetic (NM) layers is developed. The formalism is based on the 3D circuit network of spin-dependent-resistor elements (SDRE) whose electrical response is calculated by Valet-Fert 1D model. With this formalism, nanopillars with various electrode shapes are investigated. The calculated electrochemical potential profiles show the difference between the constriction type and the S-constant and column types. In the constriction type pillar, the top infinite Cu layer is a strong spin-flip scatterer providing large volume for spin current to be scattered. This suppresses the splitting of the electrochemical potential and therefore modify its profile. Based on the numerical analyses, two kinds of nanopillars are fabricated with 15 nm Pt and 20 nm Au as top layers. The spin-flip resistance of Pt is only half of that of Au, indicating that Pt is a stronger spin-flip scatterer than Au. Also, the Pt top layer reduces the critical switching current density JCSby about 25% compared to Au top layer. The effects of the interfacial perpendicular anisotropy in both cases are found almost the same. [C566]

"Nano-structure and magnetic properties of as quenched Fe based ribbons"

In this work, the nano-structure and magnetic properties such as saturation magnetization, effective permeability and magnetostriction in Fe-Cu-Nb-Si-B and Fe-Zr-B-Cu as quenched ribbons were investigated. [C567]

"Shape induced anisotropy in hybrid anti-dot arrays from guided self-assembly templates"

Ordered templates are used for electro-deposition of different magnetic materials. This technique offers new opportunities, which are not easily realized by standard lithographic methods, and which allows creation of magnetic nanostructures with 3D architectures on broad range of length scale. To address limitations of self-assembly, hybrid techniques using well established Si technology to guide and confine self-assembly templates is employed. Magnetic measurements are performed using superconducting quantum interference device (SQUID), a vibrating sample magnetometer and a magneto-optical Kerr effect rig. Electrical properties are studied using a four-point probe configuration. Magnetic structures have been imaged using magnetic force microscopy (MFM). Obtained results are analysed using micromagnetic simulations and simple analytical models of domain wall pinning and magnetization curling behavior. [C568]

"High-coercivity Co-ferrite thin films on SiO2 (100) substrate prepared by sputtering and PLD"

Co-ferrite thin films are interesting for magnetic recording and magneto-optical devices. In this work, we have prepared Co-ferrite thin films on SiO2substrate with high coercivity by sputtering and PLD. The film thickness was around 50 nm. All the films were subsequently annealed at a temperature of 500 to 1000°C. As-sputtered Co-ferrite film possessed an amorphous-like structure, as no X-ray diffraction peak was observed. Crystallization required an annealing at 500°C or higher. High coercivity was obtained after annealing at 900-1000°C. High coercivity was associated with nanostructure. Hysteresis loops of the samples were annealed at 900°C. It has been found out that substrate also played an important role. Similar trend of magnetic properties was observed in PLD-derived samples. [C569]

"Fabrication of core-shell type magnetic nanoparticles by a nanocluster deposition technique"

Nanoparticle deposition gun and on-line co-sputtering technique was used to prepare core-shell type Au@Fe65Co35nanostructures on glass substrates. The crystallization, texture and nanostructures were observed by using transmission electron microscopy (TEM), while the magnetic properties of the nanoparticles were measured by the use of a vibrating sample magnetometer. TEM observations including bright/dark images and diffraction patterns showed that all FeCo nanoparticles are single crystals and show random orientations. The hysteresis loop measured at room temperature has an average diameter of about 23 nm, and the coercivity is about 60 Oe. Au shell thickness is about 1-2 nm. [C570]

"Nano-inscription of surface relief gratings of azo dye molecular films utilizing interference of evanescent waves on prism surface"

A novel method was performed for optical fabrication of nano-structures on organic photosensitive thin films utilizing evanescent waves on prism surface. The evanescent waves are produced by means of total internal reflection of laser beams on a prism surface and the intensity shows exponential decay from the surface. Nano-patterns of surface relief gratings (SRGs) were inscribed for spin-coated azo dye (congo red) films showing photoisomerization by the evanescent waves. The cycle pattern of the SRG was approximately 210 nm that was smaller than a half of the incident laser wavelength of 488 nm. In the conventional technique of fabrication of SRGs, it is very difficult to obtain narrower lattices and one can not obtain any smaller lattices of SRGs than a

half wavelength of the laser beam. This techniques based on molecular migration due to evanescent waves are thought to be very useful for nano-device processing and future device applications. [C571]

"Synthesis and magnetic characterization of ZnFe2 O4 nanostructure in AAO template"

Zinc ferrite nanowires inside an AAO template is fabricated using a novel technology different from electrodeposition. The physical and chemical properties of the nanowires is investigated by TGA, IR, XRD, SEM and SQUID. The nanoparticles embedded into the pores exhibited superparamagnetic behavior with the blocking temperature of 15 K. However, after annealing, the particles formed nanowires and the hysteresis of the annealed samples increased significantly. Microwave properties of the ferrites are studied using ferromagnetic resonance technique and the change in the resonant curve linewidth due to annealing is observed. [C572]

"Fabrication of magnetorestrictive sensors using self assembled nanosphere mask"

Co-Cu-Co pseudo spin valves nanostructures are fabricated to investigate their magnetoresistance properties. Vibrating sample magnetometer study of the continuous reference trilayers shows that the ferromagnetic layers are coupled antiferromagnetically through spacer layer. The hysteresis loops of these layers show easy axis to be in plane. Magnetoresistance (MR) measurements were performed with the applied field parallel to the plane of the sample, at different angles with respect to the current direction. [C573]

"FeHfN and FeHfNO soft magnetic films for RF applications"

In this work, recent improvements on high magnetization FeHfN films for RF-use and possibility of very high resistivity with introducing oxygen during deposition are investigated. The films are deposited at room temperature by reactive RF diode sputtering in a mixed Ar + N2atmosphere. N-incorporation leads to lattice expansion and grain size refinement. Up to N 10 at.%, the films consist of very fine nanostructure, encompassing excellent magnetic properties and retaining relatively high magnetization. The resistivity ρ increases almost linearly with N but remains at a moderate value for N 10 at.%. However, the soft magnetic properties rapidly degrade and the 4piMs strongly decreases while the film consists of amorphous-like microstructure with scattered large HfN precipitates. Having 4piMs = 19 kG, Hk = 20 Oe, and ρ = 130 μΩ-cm, a natural ferromagnetic resonance frequency occurs at 1.84 GHz with dc permeability μ' close to 1000. The insertion of small O2flow rates is instrumental in increasing ρ above 1000 μΩ-cm. A few O2flow rate also allows a soft magnetic behaviour with Hk increasing with O2. The N-incorporation in FeHfN results in promoting and increasing Hk, the O2addition seems to compete with the nitrogen effect. [C574]

"Magnetic properties of Fe3 O4 nanostructures"

In this research, nano-dot array with magnetite (Fe3O4) nanoparticles using an anodized aluminum oxide (AAO) nanotemplate is produced. The hexagonally ordered nanotemplates are created using a two-step anodization method. After a pore-widening process of the nanotemplates, the 10 nm nanoparticles are inserted by magnetic stirring method. Annealing of the nanostructures at 500°C for 1 hr is done. Surface and cross-section of the template filled with nanoparticles are observed by field emission scanning electron microscopy (FESEM). At as-filled state, the nanostructure shows low coercivity of 20 Oe but after annealing, it increased to 85 Oe. The magnetic properties of nano wires consisting of nanoparticles are improved due to recrystallization and grain growth of each magnetic particles and their structure may be changed due to agglomeration. [C575]

"The effect of substrate off-cut on the morphology of self-organized InAs nanostructures on InP[C001]"

Self-organized InAs nanostructures on vicinal InP(001) may form either as quantum dots or as quantum wires. We show that using GSMBE, the resulting morphology depends on the substrate off-cut, but not on growth conditions [C576]

"Laser direct imprint of silicon nanostructure with low damage on Si for optical devices"

Laser direct imprint technology of silicon nanostructure has only 56cm/s change in surface recombination velocity, with excimer laser peak intensity of 1~2J/cm2, imprint pressure of 10~100g/cm2, and high vacuum at 10-6torr. [C577]

"Reflectivity change in femtosecond-laser-induced ablation of diamond-like carbon film"

Observing the characteristic change in reflectivity of the film surface, we have studied the formation of periodic nanostructure on diamond-like-carbon (DLC) films irradiated by fs laser pulses. In the time-resolved

measurement of the reflectivity using the pump-probe technique, a large enhancement of the reflectivity was observed, suggesting a specific phase transition in the fs-laser irradiated film surface. [C578]

"Why is the room temperature optical differential gain of zero, one and two dimensional semiconductor lasers nearly identical"

We model the differential gain in nano-structure semiconductor lasers. Quantum dots, wires and wells are compared and are found to have nearly the same room temperature differential gain. [C579]

"Planning and Control for Automated Nanorobotic Assembly"

Nanomanufacturing using Atomic Force Microcopy has been widely investigated. Most of nanomanipulation schemes go through the scan-design-manipulation-scan cycle manually which is time consuming and inefficient. Automated AFM tip path planning is desirable for nanomanufacturing, but does not receive much attention. In this paper, a CAD guided automated nanomanufacturing system is presented. Based on the CAD model of a nanostructure, the manipulation paths for both nanoparticles and nanorods are generated automatically. A local scanning method is developed to compensate for the random drift that may cause the failure of the nano-assembly. The experimental results demonstrate that the developed algorithm can be employed to manufacture nanostructures efficiently. The research work opens a door to the CAD guided automated nanomanufacturing. [C580]

"Scalable highly-anisotropic reactive ion etch on Si for nanophotonics"

In this work, we demonstrate both scalability down to decanometer and high anisotropy up to 90% in fabrication of Si nanostructure by reactive ion etching. Silicon nanorods with 20 nm diameter size are fabricated on single-crystalline silicon surface [C581]

"Sub-micron all-optical memory and large scale integration in photonic crystals"

We demonstrate ultra-high speed, low-power and digital all-optical memory action in photonic nanostructures. We show how large-scale on-chip integration of all-optical devices can be achieved without any optical isolators, even in the presence of reflections [C582]

"Optical Dew Point Sensor using Plasmonic Resonance of Cap-shaped Silver Nanoparticles"

An optical dew point sensor based on plasmonic resonance effect of Ag nanoparticle array is described. Plasmonic response from Ag nanostructure allows sensing subtle change of refractive index according to adsorption of H2molecules. [C583]

"Ultrasensitive and nanoscale Raman spectroscopy in biomedicine"

This paper is about a new methodological approach in spectroscopy, the Raman spectroscopy, which combines the interesting optical properties of nanostructures with modern laser spectroscopy. Ultra sensitive Raman measurements at the single molecule level for biomedically relevant molecules, such as DNA fragments, neurotransmitters, proteins, as well as surface enhanced Raman scattering (SERS) studies in single living cells are reported and potential capabilities and limitations of spectroscopies exploiting local optical fields of nanostructures in the biomedical field are discussed [C584]

"Control challenges in semiconductor nanostructure devices"

A superlattice is an artificial crystal made out by repeating periodically a basic unit comprising layers of two or more semiconductors. Superlattice based devices include infrared detectors, quantum cascade lasers and fast oscillators. A simple device consists of a finite superlattice with attached contacts and connected to an external circuit. If it is connected to a current source, the electric field profile inside the superlattice may be a wave front, which is possible to leave stationary or to move upstream or downstream of the electron flow depending on the value of the current. Under dc voltage bias, it is possible to attain stationary states or self-sustained oscillations of the current by controlling the voltage. [C585]

"Using Pt Dopant and Sol Gel Technology for Sensitivity Enhancement of TiO2 /SnO2 Humidity Sensors"

The sensitivity of the humidity sensor based on hybrid thin films of nanostructure TiO2/SnO2with Pt dopant was successfully increased. The humidity-sensitive materials, TiO2/SnO2, were prepared by sol gel technology. The

microstructure of the sensing film after calcination was investigated by the field emission gun scanning electron microscopy (FESEM) and revealed that the metal oxide hybrid had about 10 nm grain size. For studying the effect of Pt dopant on the humidity-sensitive responses, 1 ml to 10 ml of Pt standard solution was added into the colloidal solution. To compare the humidity sensor of Pt dopant with that of no Pt dopant, operational frequencies and electrode spacing were set under the relative humidity from 30% to 95% at the ambient temperature of 22degC. We demonstrated that adding Pt dopant remarkably enhanced the sensitivity of TiO2/SnO2humidity sensor, and further decreased the TiO2/SnO2 resistance, which was 3.3 times lower than that without Pt dopant at the high humidity [C586]

"Surface sensitization of metal oxide quasi-1D sensors: in situ comparative study of pristine and Pd doped individual SnO/sub 2/ nanostructure"

We have developed the technique for in situ monitoring of the process of surface functionalization of the pre-selected 1-D nanostructure with catalytic particles of Pd. The method allows us to compare directly the sensing performance of the individual SnO2 nanobelt chemical sensor before and after surface sensitization. The conductance evolution at early stages of the metal deposition before percolation indicates that Pd nanoparticles formed on the nanowire surface induce regions depleted with electrons which narrow the effective conduction channel and therefore are responsible for the conductance drop. After being functionalized with Pd the nanostructure exhibited drastic improvement of the sensitivity toward oxygen and hydrogen due to enhanced activation of molecules on Pd nanoparticle surface and diffusion of resultant reactive species to the oxide surface [C587]

"A Source of Ultra-Low-Energy High Intensity Gaseous Ions Based on Discharge with Electron Injection"

Summary form only given. Biased target deposition is a promising sputtering technique for the fabrication of thin films and nano-structures requiring control of interfaces in multi-layer devices at the atomic level. One of the main requirements for this technique is an ion source that can produce several amperes of directed ion flux at kinetic energies of about ~20 eV or less. The maximum energy is given by the sputter threshold of materials present in the processing chamber. Closed-drift, anode-layer and end-Hall sources appeared to be adequate for some applications. However, recent experiments showed that they produce either too low ion current at low ion energy, or the ion energy became too high when large enough ion currents were achieved. Here we describe a novel version of an ultra-low-energy high-intensity ion source (which we dubbed "ULEHIIS") that can serve as possible alternative to Hall current ion sources. The ULEHIIS is based on a two-stage, low-pressure, high-current gaseous discharge. The first stage serves as an electron emitter to the second stage. The second stage, a non-self-sustained main discharge, provides acceleration of emitted electrons and ionization of the operating gas. With a discharge current of 35 A in argon, the maximum argon ion beam current on a target of 500 cm2was as high as 4.5 A, with the ion energy spread less than 10 eV [C588]

"Simulation study of junction effect on field emission from one-dimensional nanostructure grown on silicon substrates"

Field emission properties of the one-dimensional nanostructure grown on doped silicon substrate are studied via computer simulation. The classical transport equation is used to describe the carrier transportation in the material and is solved coupled with the Poisson's equation. The field emission process between emitter and vacuum interface is modeled by the Fowler-Nordheim equation. For studying the space-charge screening effect, the carriers are allowed to move in the vacuum region, and the space-charge fields of the carriers are also solved self-consistently through the Poisson's equation. After the simulation, the F-N plot, the carrier distribution and the band structures are figured out. The simulation results of the anode current as a function of the applied voltage for single SiCN grown on n- and p-type doped silicon substrates are shown. The simulation results exhibit that the p-type substrate will limit the emission currents of the narrow- and wide-band-gap nanostructure at the high-field region. And the space-charge screening effect will further saturate the emission current. [C589]

"Dynamic growth process of W-nano-branched structure on insulator substrate studied with transmission electron microscopy"

Controllable fabrication of nanostructure is important and necessary to application of nanomaterials in technology. Among the methods of fabrication of nanostructures, electron-beam-induced deposition (EBID) is a promising method. A transmission electron microscope (TEM), JEM-2010F operated at 200 kV, was used for fabrication of nanowires and nano-branched structures. Thin film samples Of SiO2or Al2O3were used as substrates. Tungsten hexacarbonyl (W(CO)6) powder was used as a precursor. The base pressure in column is lower than 2 Ч 10-5Pa. A gas introducing system which has a nozzle with an inner diameter smaller than 0. 1

mm and a reservoir of powder gas-source was used. The fabricated structures were characterized in-situ or after the fabrication with JEM-2010F TEM. All the experiments were performed at room temperature. Nanowires in diameter of about 3 nm nucleate on surface of substrate after starting the electron irradiation with intensity lower than 0.75 A/cm2. They nucleate and grow within the all area electron beam irradiated. They grow almost normally to the surface of the substrate with distances of several nanometers between each other. [C590]

"Formation of nanostructures by selective-area MOVPE and their applications"

Semiconductor nanostructures have been attracting particular attention as fundamental building blocks for nanoscale electronics and photonics in the bottom-up approach. One of the key issues is to realize high-quality and high-density nanostructures with accurate size- and site-controllability. Selective-area (SA) growth on masked substrates using metal organic vapor phase epitaxy (MOVPE) is one of the most effective and versatile techniques to realize nanostructures satisfying these requirements, because the nature of the epitaxial growth is fully utilized and a variety of structures can be realized by appropriate choice of the substrate orientation and design of the mask pattern. Here we present some of our recent results on the formation of nanostructures by SA-MOVPE and their application to nanoscale devices and circuits. [C591]

"Local origins of sensor activity in 1D oxide nanostructures: from spectromicroscopy to device"

We have tested a range of imaging techniques to address local transport behavior in the working metal oxide nanostructure sensor. In particular, we were using scanning surface potential microscopy (SSPM) to dc potential distributions in an operating device. We also have successfully implemented of synchrotron radiation based photoelectron emission spectro-microscopy (PEEM) to explore submicron lateral compositional and electronic (work function) inhomogeneousity in individual nanowire sensor. These results open new avenue to visualize the adsorption / desorption phenomena on individual nanostructure both in real time and at nano- and mesoscopic level [C592]

"Crystallization of focused-electron-beam deposited tungsten wire on molybdenum substrate"

Increasing attention has been paid to the usage of focused-electron-beam in the field of nanofabrication. It was verified that electron-beam-induced deposition (EBID) is capable of fabricating nanostructures on the nanometer scale. Among various precursors, tungsten hexacarbonyl [W(CO)6] has been widely used to repair microelectronic masks and to fabricate supertips. Their properties (e.g. conductivity, field emission) are closely related to the metallic content in the structure (Hoyle, 1994). However, the as-deposited structures of W(CO)6are polycrystalline materials, which consist of nanocrystallines (tungsten, tungsten oxides and tungsten carbides) embedded in an amorphous carbon containing matrix (Han, 2004). In order to increase the tungsten content, heating of as-deposited tungsten wire was carried out and its crystallization on molybdenum substrate was investigated in the present study. [C593]

"2005 Conference on Lasers and Electro-Optics Europe (IEEE Cat. No. 05TH8795)"

{no data available} [C594]

"New insights in to the mechanisms of fullerene and nanotube formation"

In 1985 buckminsterfullerene (the third allotropic form of carbon) was discovered during experiments designed to unravel the chemistry in red giant carbon stars. The molecule has now come down to Earth giving rise to the fullerenes, a family of pure carbon cage molecules with fascinating properties which promise exciting new developments in 21st century materials science and technology. Fullerene molecules and their elongated nanotube (buckytube) cousins are now the subject of intense study as they promise to play major roles in almost every possible area of future technology from medicine and molecular electronics to civil engineering. However the mechanisms whereby various types of nanostructures assemble are still very poorly understood. Over the last decade or so, we have examined a wide range of methods for nanotube formation and from these studies some interesting new insights have been gained-especially with regard to metal catalysed nanostructure formation. [C595]

"Development of Environmentally Conscious Photo-Synthetic/Metabolic Bio Fuel Cell"

Design of a photosynthetic/metabolic based bio-fuel-cell and fabrication processes to make it have been explored and developed. Novel nanostructure and modified Poly-aniline have been used to enhance the performance of the new bio-fuel cell. The mechanism of the electron transfer process and the electro-catalysis of Poly-aniline have been investigated. The developed Direct Photosynthetic/metabolic Bio-Fuel Cells(DPBFC) with 150muA/cm2current density have been demonstrated [C596]

"Compound semiconductor optoelectronics research at the Australian National University"

Synopsis of the projects currently undertaken by the group are briefly discussed in the paper: (i) nanostructure growth, (ii) novel materials, (iii) quantum dot electronic devices, (iv) integrated optoelectronic devices, (v) photonic crystals, (vi) semiconductor THz emitters and detectors, (vii) ZnO ion beam processing and (viii) Bose Einstein condensate of excitons. [C597]

"Impact of nanotechnology in flat panel display industry"

Summary form only given. Flat panel display industry is a highly competitive area, globally driven by the intricate balance between technical advancement toward better performance and the ever demanding production cost. Along the vertically integrated manufacturing of FPD's, there always exists a technology-cost bottle neck that defines and often limits the growth of the market. Nanotechnology, as a collective field of precision materials science and engineering, provides rich opportunities in innovations in all aspects of FPDs: Carbon nanotubes for efficient field emission display, patterned surface-alignment for memory LCDs, nanostructure-reinforced glass substrate, nanophase-separated polymer films for self-assembled antireflection coating, nano-metalic particles for conductive ink semiconductor quantum dots for color filters and fluorescent screens nano-imprinting, scanned probe fabrication, high-resolution inkjet printing, and many more. In the face of FPD development in the past few decades, these emerging technologies appear qualitatively new and sometimes even disruptive in the sense that, if properly integrated, they will profoundly revolutionize the basis of the industry. In this paper, the author would like to outline my personal perspective about how this will happen and change the industry to become compatible with the increasing environmental pressure without sacrificing the display performance. [C598]

"CONAN-a design exploration framework for reliable nano-electronics architectures"

In this paper we introduce a design methodology that allows the system/circuit designer to build reliable systems out of unreliable nano-scale components. The central point of our approach is a generic (parametrical) architectural template. Configurable nanostructures for reliable nano electronics (CONAN), which embeds support for reliability at various levels of abstractions. Some of the main reliability sources are regular and decentralized structures based on simple basic computation cells designed to be robust against disturbances and noise, fault tolerance based on hardware, time and information redundancy applied at the basic cell level as well as at higher levels, self diagnosis assisted by the dynamic reconfiguration of basic computation cells and interconnect rerouting. Within the CONAN template, both technology dependent and independent models co-exists such that the more abstract layers are technology independent while the lower levels can be retargeted to various fabrication technologies. Our proposal is application-oriented and allows the designers to deal with unpredictability, and low reliability, which are unavoidable characteristics of future emerging nano-devices. When combined with the underlying software, the tools supporting the CONAN approach allow the designer to check whether the design constraints are fulfilled before performing a detailed implementation and provides means to trade area, delay, and power consumptions for reliability. As such, this proposal is a call-to-arms to mobilize the efforts of systems designers in order to achieve a systematic design methodology for reliable systems. [C599]

"Localized growth and functionalization of silicon nanowires for MEMS sensor applications"

We present a mechanism for the growth of silicon nanowires (SiNW) directly from a silicon substrate or polysilicon block, without the use of a metal catalyst, silicon vapor or CVD gasses. This allows for "in place" growth of nanostructures without further need for manipulation or alignment for subsequent applications. Wires in the 2040 nm diameter range with lengths over 85 μm can be easily grown by this technique. The critical parameters in the growth of these nanowires are the surface treatment and the carrier gas used. The growth and functionalization of SiNW can enhance the sensitivity of sensor systems. Wire growth is stress driven and enhanced by surface Si atom diffusion due to the presence of hydrogen gas. [C600]

"High loss multilayer films for control of electro-magnetic interference"

A nanostructure multilayer film, composed of magnetic alloy CoFeZrNd layer and nonmagnetic insulator SiO2layer, was adopted as the composite structure material. The CoFeZrNd/SiO2multilayer films were synthesized by magnetron sputtering. Microstructures, electromagnetic parameters and microwave characteristics were all measured and analysed. Results show that these magnetic nanostructure multilayer films can be used in control of EMI in circuits and systems. [C601]

"Non-occurring and rare quads in PDB and translated introns from XPro with possible applications in nanostructure design"

Exhaustive search over 17313 unique protein sequences in the database PDB indicates the absence of 4036 of the 160000 possible subsequences of four residues (quads). When the polypeptides obtained by translating 100000 prion sequences in the database XPro are searched the number drops to 424, which still exceeds what would be obtained by pure chance. More generally there are 11444 quads that occur 3 or fewer times in PDB. Using the Kyte-Doolittle hydrophobicity index, the 4036 quads (including the 424 absent in XPro) are divided into 16 groups, five of which can form unbroken helices or sheets by repetition. Most of the 16 groups are evenly distributed, one exception being quads with all-apolar residues, which are significantly less frequent. The helical and sheet structures so formed are artificial polypeptides not observed in nature. By using patterns from the other 11 groups more complex structures can be formed. Such structures could potentially serve as tubules and substrates in nanostructure design. [C602]

"Registration of infrared single photons by a two-channel receiver based on fiber-coupled superconducting single-photon detectors"

Single-photon detectors (SPDs) are the foundation of all quantum communications (QC) protocols. Among different classes of SPDs currently studied, NbN superconducting SPDs (SSPDs) are established as the best devices for ultrafast counting of single photons in the infrared (IR) wavelength range. The SSPDs are nanostructured, 100 μm2in total area, superconducting meanders, patterned by electron lithography in ultra-thin NbN films. Their operation has been explained within a phenomenological hot-electron photoresponse model. We present the design and performance of a novel, two-channel SPD receiver, based on two fiber-coupled NbN SSPDs. The receivers have been developed for fiber-based QC systems, operational at 1.3 μm and 1.55 μm telecommunication wavelengths. They operate in the temperature range from 4.2 K to 2 K, in which the NbN SSPDs exhibit their best performance. The receiver unit has been designed as a cryostat insert, placed inside a standard liquid-helium storage dewar. The input of the receiver consists of a pair of single-mode optical fibers, equipped with the standard FC connectors and kept at room temperature. Coupling between the SSPD and the fiber is achieved using a specially designed, precise micromechanical holder that places the fiber directly on top of the SSPD nanostructure. Our receivers achieve the quantum efficiency of up to 7% for near-IR photons, with the coupling efficiency of about 30%. The response time was measured to be -1. The presented performance parameters show that our single-photon receivers are fully applicable for quantum-correlation-type QC systems, including practical quantum cryptography. [C603]

"GaAs-oscillators of mm-range with small levels of power consumption for engineering of nanostructures"

Oscillators are experimentally investigated on the basis of GaAs Gunn-diodes with small levels of power consumption 10...30 mW. useful microwave power 0.1...0.3 mW with efficiency 1...2% in a range of frequencies 65...75 GHz. [C604]

"Laser patterning-innovative technology for mass production of microstructures"

The improvement of pattern resolution for microsystems fabrication is certainly a proven method for increasing of micro and nanostructure density. Our novel laser technology could be applied for thin metal or alloy films on polymer substrates, which could be structured directly with the laser direct patterning process. So is possible to manufacture ultrafine conductive or reflective structures down to 15 μm in an economical and environmentally friendly way. Increasing demand on the accuracy of microsystems and sensors requires microstructures with lines and spaces down of approximately 5-100 μm. [C605]

"Growth of titanium oxide nanorods"

Nanorods of titanium oxide (TiO2) were obtained by thermally activated growth process carried out on pellets of nanocrystalline powder with mixed anatase and rutile structures. The nanostructured array consists of nanorods with length between 300 nm and I μm and hexagonal cross section of 100-200 nm diameter. Herein it is shown that one can obtain information on the nanostructure growth from cathodoluminescence emission spectra. The growth process of the rods is mainly associated with the presence of the anatase phase. The key role of characteristic defects in semiconductor oxides, namely oxygen vacancies and Tin+ions is discussed. [C606]

"Large reciprocal polarization rotation in planar chiral metal nanostructures"

We observe large reciprocal rotation in quasi-2D chiral metal gratings. The effect originates from asymmetric coupling of surface modes centered at the air and substrate interfaces and violates neither reciprocity nor reversality of light-matter interaction. [C607]

"Nanoshuttles driven by biological motors"

Biological motors are used by cells to actively transport ions and molecules against concentrations thereby establishing non-equilibrium conditions that are essential for many life processes. Borrowing from nature, we are developing insights into how to engineer nanoscale transport systems based on the biological motors kinesin and microtubules. Molecular shuttle systems may enhance the detection efficiency of analytical microfluidic systems or facilitate the controlled assembly of sophisticated nanostructures if transport can be coordinated along complex track networks. Methods have been developed to control the speed of the nanoshuttles with light, and we evaluated how various synthetic polymers affect the lifetime of these biomolecules embedded in integrated hybrid devices. We could also show that kinesin-driven transport can be utilized to drive the self-assembly of mesoscopic structures that would not form in the absence of active transport. [C608]

"Silicon photonics"

Summary form only given. The convergence of electronics and photonics in a monolithic silicon platform brings about unprecedented information processing capacity. Silicon photonics yields a scalable solution to the anticipated barriers of interconnection bandwidth and latency, input/output density, and electronics/photonics partitioning. This is further propelled by our theoretical understanding of optical nanostructures from first-principles and by successes in nanoscale optical device nanofabrication, from which we can now practically prescribe the properties of synthetic optical nanostructures. We discuss a specific example of a silicon optical nanostructure, which exhibits the possibility of large-scale CMOS deployment of the resulting silicon nanophotonics technology. [C609]

"Electric field-induced color switching of luminescence from ZnO nanoparticle/polymer nanostructure"

We report on reversible switching induced by an electric field between blue-green and red cathodoluminescence (CL) in the ZnO:Mg nanoparticles/poly(4,4'-diphenylene diphenylvinylene) (PDPV) nanostructure. It has been found that PDPV-ZnO:Mg nanostructures shows the CL emission maximum in the blue-green region without an electric field. The positive bias voltage suppressed the blue-green emission and shifted the emission maximum to the red region. The mechanism for the formation of the exited states in PDPV-ZnO:Mg nanostructures is discussed. It implies the presence of radiative recombination channels, which can be adjusted by a biased voltage to the free carrier depletion or accumulation mode. [C610]

"Adaptive silver films for bio-array applications"

Summary form only given. The adaptive property of e-beam evaporated silver films has been studied and employed for protein sensing with surface-enhanced Raman scattering (SERS). Our approach for sensing proteins is based on adaptive silver films (ASFs); the method allows fine nanostructure rearrangement under protein deposition that makes it possible to soft-adsorb proteins on the metal surface and to form aggregates of nanoparticles which are optimal for SERS. We demonstrate that adaptive nanostructured films can be used for the observation of differences in SERS spectra of recombinant human insulin and insulin lispro at sub-monolayer protein surface densities and provide macroscopic enhancement factor of about 3Ч106. Since human insulin and its analog have the same set of side chains and differ only in conformational states, the observed difference indicates the preservation of the conformational state with the use of adaptive metal substrates. Direct, label-free detection of antibody-antigen binding at a monolayer protein concentration has been also demonstrated, using SERS detection on adaptive silver films. This includes evidence of distinct SERS spectral changes upon antigen-antibody binding and independent biochemical sandwich assay validation studies, which confirm that antibodies retain binding properties on ASFs. It is shown that proteins stabilize the ASFs and restructure them so that proteins can preserve their binding activity. We demonstrate the ability to employ various detection methods with one substrate, including label-free SERS, chemiluminescence, fluorescence, and further analysis of protein spot retrieved from the surface. [C611]

"Application of metal nanoparticles in confocal laser scanning microscopy"

We describe experiments in which the field enhancement by silver nanoparticles upon surface plasmon excitation has been exploited in confocal laser scanning microscopy to improve the resolution in the direction of the laser beam. [C612]

"2004 IEEE LEOS Annual Meeting Conference Proceedings (IEEE Cat. No.04CH37581)"

{no data available} [C613]

"Nanostructure imaging with sub-THz coherent acoustic phonon pulses"

We describe a novel imaging technique that employs coherent acoustic phonon pulses which are generated and detected by ultrafast optical methods. Sub-micron resolution images of Al lines lithographically etched on a Si substrate are shown [C614]

"CAD-guided manufacturing of nanostructures using nanoparticles"

The development of nanomanufacturing technologies will lead to potential breakthroughs in manufacturing of new industrial products. Nanomanufacturing by manipulating nanoparticles using an atomic force microscope is desirable to manufacture asymmetric nanodevices and nanostructures. The complexity of nanomanufacturing requires positioning, manipulating and assembling nanoparticles. Typical manual nanomanipulation is time-consuming and inefficient. Automated path planning is desirable for nanomanufacturing, but does not receive much attention. In this paper, a general framework is developed to manufacture nanostructures and nanodevices. An automated tool path planning algorithm is presented. Simulations are performed to test the generated paths. The generated paths are also implemented to manipulate nanoparticles to manufacture nanostructures automatically. The simulation and experimental results are consistent. The general framework can also be extended to manipulate other nanoobjects. [C615]

"Integration of conducting polymer micro- and nano-actuators with semiconductor photonic devices"

In this work, PPy (polypyrrole) doped with DBS (dodecylbenzenesulfonate) anions is used as actuators or "artificial muscles". Microactuators described in this study are fabricated by electrochemically polymerizing PPy on patterned Au thin film deposited on a Si pn junction. A PPy nanostructure has been fabricated on a semiconductor substrate, enabling future integration with electronic or photonic devices. [C616]

"Two-photon 3D lithography: materials and applications"

This study demonstrates the fabrication of a representative set of microstructures based on the three classes of two-photon photoactive materials compositions. Such structures can be used directly for suitable applications but can also be used as templates for the growth or molding of other materials as needed for a specific application. Given the ability of the two-photon lithography to produce 3D patterns of arbitrary structure, there is potential for the fabrication of an essentially limitless number of micro- and nano-structures in a wide variety of materials compositions. [C617]

"Influence of metal gate materials and processing on planar CMOS device characteristics with high-k gate dielectrics"

Scaled CMOS transistors with several types of metal gates on hafnium based high-k dielectrics were processed and studied to understand the influence of metal gates on device characteristics. The different metal gates that were comparatively studied include (a) TiN processed by ALD and PVD, and (b) PVD processed TaSiN and a multilayer HfN/Ta/TiN stack. From comprehensive electrical and nanostructural characterization, it was concluded that the differences in the properties of the devices, with ALD TiN gate electrodes compared to PVD TiN were due to the presence of the additional process grown interfacial oxide layer in the former samples. When comparing the TaSiN and multilayer HfN/Ta/TiN stacks, it was noted that the variation in device characteristics could be explained by the higher amount of nitrogen pile up at the high-k-Si interface for the multilayer metal stack. In all cases, the influence of processing on the nanostructure was addressed and a preliminary understanding of the processing-structure-property interrelationship is presented. [C618]

"Novel designs of NOR2 and NOR3 logic gates using single electron transistors"

We have proposed gate architectures to perform NOR logic operations using the single electron transistors. The designs have been verified by using the SET-SPICE model and the nanostructure modeling software called SIMON. First, a two-input NOR gate was designed and verified and then the design was extended to implement a NOR gate with three inputs. [C619]

"Assembly of nanostructure using AFM based nanomanipulation system"

Assembly of nano-structures involves manipulation of nanoparticles, nano-rods, nanowires and nanotubes. Modelling the behavior of a nano-rod or a nanotube pushed by an AFM tip is much more complex than that of a nano-particle because in the case of the nano-particle usually only translation occurs while for the nano-rod and nanotube both translational and rotational motion occurs during manipulation. In this work, the behavior of nano-

rods under pushing is theoretically analyzed and the interaction among tip, substrate and nano-rods has been modelled. Based on these models, the real-time interactive forces are used to update the AFM image. The real-time visual display combined with the real-time force feedback provides an augmented reality environment in which the operator not only can feel the interaction forces but can also observe the real-time changes of the nano-environment. The new developed augmented reality system capable of manipulating not only nanoparticles but also nano-rods makes nano-assembly using AFM based nanomanipulation system feasible and applicable. [C620]

"A thermally actuated three-probe nanomanipulator for efficient handling of individual nanostructures"

We report recent development of a three-probe micromachined nanomanipulator for manipulation and in-situ characterization of nanomaterials in scanning electron microscope (SEM). The nanomanipulator consists of three independent probes having thermal bimetallic actuators and nanoscopic end-effectors. Nanoscale end-effectors with sub-100-nm spacing are created using focused ion beam (FIB) milling to directly interface with nanoscopic objects (e.g., nanotubes, nanowires). Handling of individual carbon nanotubes (CNTs) was successfully realized with the nanomanipulator in an SEM. [C621]

"2004 Digest of the LEOS Summer Topical Meetings: Biophotonics/Optical Interconnects & VLSI Photonics/WGM Microcavities (IEEE Cat. No.04TH8728)"

{no data available} [C622]

"Synthesis and field emission properties of carbon nanosheets"

A nanometer edged two-dimensional graphite structure, carbon nanosheet, was synthesized by inductively coupled radio-frequency plasma enhanced chemical vapour deposition on a variety of substrates, including metals, semiconductors and insulators. The carbon nanosheets were characterized by scanning electron microscopy, high resolution transmission electron microscopy and Raman spectroscopy. Edges of nanosheets had a uniform thickness of about 1 nm. Typical nanosheets consisted of only a few atomic layers and had a graphitic structure. The high density of atomic scale vertical graphitic edges are potential sites for electron field emission. The carbon nanosheets had a turn-on (threshold 10μA/cm2) field of about 5 V/μm and a metallic behavior based on a linear Fowler-Nordheim plot. This sheet-like carbon nanostructure is expected to be a robust edge emitter. [C623]

"A novel light emitting device based on Si nanostructures and tunneling injection of carriers"

Silicon was not used for light emitting devices (LEDs) as it is an indirect bandgap material and has very low radiative recombination rate and short photon lifetime. This fundamental material property limitation has been overcome. Recent efforts have demonstrated that the light emitting efficiency can be enhanced greatly and lasing effect is also possible with the low-dimensional (LD) silicon materials. In this work, a novel light- emitting device structure based on Si/SiO2/LD Si/Si3N4/Si system is proposed. The low-dimensional Si governed the photon generation efficiency and energy spectrum whereas the asymmetry barrier heights formed by the SiO2and Si3N4provide high efficiency carrier injection based on direct tunneling and maximizes the recombination events taking place in the LD Si region. Quantum calculations on the charge transports, including the direct tunneling carrier injection at the Si/SiO2interface and band-to-band recombination of in the LD Si, were conducted. [C624]

"Chaotic dynamics of instable nanoelectron systems (millimeter wave band simulating)"

The goal of the report is to pay attention to an opportunity of unstable nanoelectron systems simulating by macroscopic quasioptical devices of millimeter wave band. The mesoscopic metal clusters, semi-conductor quantum dots and rings, which sizes about 100 nm, containing bulk inhomogeneities or rough borders, are belonged to such systems. These objects due to the finite character of electron motion named as instable "quantum billiards". In "quantum billiard", not containing inhomogeneities the electronic spectrum is discrete, and the own states are stability. However, character of a spectrum and stability of a system state are rather sensitive, frequently critically, to various sorts random inhomogeneities, both in volume of structure, and on its border. These inhomogeneities cause the instability in electron motion, which can result to chaotization of an energy spectrum, and, thus, to affect the basic physical properties of a system. From here it is visible, that the study of the character of an electron spectrum enables to test of nanostructure from the point of view of its use in semi-conductor devices. The nanoelectron system simulating by quasioptical microwave resonators of the millimeter wave band allows to clear in details the influence of structure inhomogeneities on the "quantum billiard"

spectrum and to find out the basic mechanisms resulting in instability of electron system and the spectrum chaotization. The opportunity of nanoelectron structures stimulating by quasioptical microwave resonators is based on the following. Though the vector Helmholtz equation, describing oscillations in such resonators is not strictly equivalent to the scalar Shrodinger equation for mesoscopic structure, between the solution of these equations in quasioptical approximation, there is a certain conformity. [C625]

"Spontaneous polarization induced growth of ZnO nanostructures"

We report the success of controlled synthesis of freestanding ZnO nanobelts whose surfaces are dominated by the large polar surfaces. The nanobelts grow along the-axis, their large top/bottom surfaces are the ±(0001) polar planes, and the side surfaces are (01 | 0). Owing to the positive and negative ionic charges on the zinc- and oxygen-terminated ±(0001) surfaces, respectively, the nanobelts form multi-loops of nanohelixes/nanosprings for the sake of reducing electrostatic energy introduced by the polar surfaces. The polar surface dominated ZnO nanobelts/nanohelixes are likely to be useful building blocks for nanodevices in MHMS/NEMS or biosensors. [C626]

"Fabrication of ultra-thin InP membranes and their application for high reflective mirrors in tunable vertical-cavity devices"

In this paper, InP membranes featuring a thickness of only 123 nm are presented for the first time. The chosen thickness of the air-gap and the InP membrane equal the optical thickness of λ/4 layers at 1.55 μm. Tunable micro-cavities have been fabricated to evaluate their tunability in dependence on the membrane thickness. Furthermore, a high reflective mirror (R>99.8%) with a stop-band of more than 800 nm has been manufactured. [C627]

"Electron microscopic and X-ray diffraction investigations of nanostructured thin films of ZnO"

ZnO films prepared by sol-gel technique using zinc nitrate and zinc acetate as precursor material have been studied using transmission electron microscopy (TEM) and X-ray diffraction (XRD) techniques. The results show the formation of zinc oxide phase. The nanostructure of the films was studied by transmission electron microscopy. Nano-structured fine grains of size ranging from 20-60 nm were observed with zinc nitrate precursor film. Individual grains show a sharp contrast with different facets and boundaries. Films prepared by zinc acetate precursor show ultra-fine nano-grains in the shape of dendrites as seen by the TEM. XRD shows a larger size of crystallites with the zinc acetate precursor. Crystal planes and lattice parameters calculated by both electron diffraction and X-ray diffraction are quite close and in agreement with the reported values in literature. [C628]

"Non-contact investigation of metal-nanostructure conductivity"

The dynamic conductivity of metal nanostructures is determined by material properties, the morphology in the volume of the nanostructure, its shape and its size, and by the structure and the chemical composition at the surfaces. IR-spectroscopic investigation of dynamic charge transport allows a distinction between such contributions. We performed in-situ IR spectroscopic measurements of metal ultrathin ([C629]

"Composition and nanostructure of carbon/silicon graded film produced by ionization-assisted deposition"

First Page of the Article [C630]

"Edge dislocation of b= [C001]/2 in the InAs nanostructure on InP(001)"

The self-organized InAs/In0.52Al0.48As nanostructure were grown on InP(001) using molecular beam epitaxy (MBE). The nanostructure has been studied using transmission electron microscopy (TEM) and high resolution transmission electron microscopy (HRTEM). The edge dislocations with the Burgers vector b =[001]/2 and extending along the [11~0] direction are observed. The results show that in the region near an edge dislocation, no InAs wires were formed, while in the regions free of dislocation, wire-like nanostructures were formed. The mechanisms for the formation of the [001]/2 edge dislocations were discussed. [C631]

"Correlation between nanocavity shrinkage with preferential amorphisation via ultrafast interaction"

We model the recent experimental results and demonstrate that the internal shrinkage of nanocavities in silicon is intrinsically associated with preferential amorphization as induced by self-ion irradiation. The paper reveals novel thermodynamic nonequilibrium properties of such an open-volume nanostructure in condensed matter and also of covalently bound amorphous materials both at nanosize scale and during ultrafast process. [C632]

"An Integrated Test Platform for Nanostructure Electrical Characterization"

We have designed and fabricated a fully-integrated CMOS-based lab-on-a-chip electronics platform to investigate the electrical characteristics of novel nanoelectronic devices. In contrast with previous work which requires the use of external equipment, therefore limiting the range of possible measurements due to parasitic capacitance and inductance, we embed the nanostructures on an integrated circuit produced with a mature 180-nm CMOS process. The test platform includes modules for measuring I-V curves with a driven current range from 100 pA to 100 μA, and a measured voltage in the 0-1.5 V range. Propagation delay measurement modules as fine as 7 ps are also included. Inputs-outputs and test configurations are controlled using a standard IEEE 1149.1 JTAG scan chain. [C633]

"NEDO Nano Coating Project: Outline and Achievements"

This project is to aim at development of advanced nano-coating processing technology through design and control of nano-coating structures with the aid of theoretical and computer techniques, since the accurate control of structures such as nano-interface, nano-pores, and nano-particles is the key to state-of-the-art coating technology. An integral part of this research is the development of fast, ultra-precise evaluation technology of the properties and performance of the coatings from the nano- to the macro-level. In this project, we have focused on an establishment of the basic technology for nanostructure control of ceramic coatings applied to metals, to provide novel functions. This technology is intended to reduce further mankind's impact on the environment and to enhance energy savings in a wide range of fields, particularly those requiring heat-resistant and corrosion-resistant materials. This project was entrusted by NEDO as "the Nanotechnology Program/the Nanostructure Coating Project" promoted by METI, Japan, and has started in 2001 and will be completed in 2006. [C634]

"MicroRaman study of Ge/Si quantum rings and dots"

The fabrication and optical measurement of Ge/Si nanostructure is presented. Atomic force microscopy (AFM) is employed to probe the surface morphology. It shows both quantum dots (QDs) and ring shape Ge nanostructure (quantum ring QRs). MicroRaman is performed to characterize the strain and composition QD and QR. [C635]

"Self-assembled silicon nano-bridges as an enabler for nano-sensors"

To build efficient sensors a large sensing area can be achieved by forming a massively parallel set of nanostructures. We have grown laterally oriented, metal-catalyzed silicon nanowires bridging between vertical (111) Si planes formed by anisotropically etching a [110]-oriented silicon wafer. The surrounding silicon can be developed into electrodes. The bridges are mechanically robust and resist significant force. By employing only coarse optical lithography to form the electrodes ("top-down" formation) combined with self-assembled ("bottom-up") fabrication of nanostructures, a large array of nano-scale sensors can be fabricated between biasing electrodes. [C636]

"Freely suspended nanostructure with no substrate beneath: fabrication and optical imaging"

Nano electromechanical systems (NEMS) were fabricated out of silicon on insulator material. The NEMS structures were reliably located on top of a hole leading through the whole substrate etched using bulk processing. The structures therefore are fully freely suspended and thus have no substrate beneath them that could interfere with the NEMS operation, e.g. electrostatically. Structures of 10 μmЧ200 nmЧ120 nm were fabricated. Confocal optical microscopy was used to image these nanostructures. Despite the wavelength of 635 nm, the structures of 200 nm width were clearly resolved and a separation of about 200 nm between two beams could also be roughly identified. In contrast to scanning electron microscopy (SEM) imaging, the optical imaging is absolutely damage free and can be easily carried out under ambient conditions. [C637]

"Spin-polarized electron transport in double-barrier semimagnetic semiconductor nanostructures"

A possibility for creating spin-polarized electron current sources with the help of a double-barrier resonant-tunneling semiconductor nanostructure composed of semimagnetic semiconductor (Zn1-xMnxSe) layers with different concentrations of manganese ions has been considered. [C638]

"Fabrication of single-electron transistors based on proximity effects of electron-beam lithography"

A simple method, based on the proximity effects of electron-beam lithography, which caused by overlapping the dosage distribution of the discretely electron beam written nano-dots, was employed to fabricate nano-structure containing narrow constrictions. A Si-based nano-dot with two narrow tunnel junctions called single electron

transistor was formed after dry etching and thermal oxidation process since the overlapping region is much narrower than the diameter of the nano-dot. The electric characteristic of the SET was found to be consistent with the expected behavior of electron transport through a gated quantum dot. [C639]

"Automated nano-assembly of nanoscale structures"

Nanoscale products have many potential applications. The complexity of nanomanufacturing requires to position, manipulate and assemble nanoobjects to form asymmetric patterns. The atomic force microscopy has been proven to be a powerful technique for nanomanufacturing. Typical manual nanomanipulation using an atomic force microscope (AFM) is time-consuming and inefficient. Automated AFM tip path planning is desirable for nanomanufacturing, but does not receive much attention. In this paper, a CAD-guided automated nanomanufacturing system is developed to manufacture a nanostructure/nanodevice based on the CAD model of the nanostructure/nanodevice. The system is implemented to manipulate nanoobjects to manufacture nanostructures automatically. [C640]

"A simple method to fabricate single electron devices"

A simple method, based on overlapping the dosage distribution of the discretely electron beam written nano-dots, was employed to fabricate nano-structure containing narrow constrictions. From the appropriately designed electron beam process, the electron dosage in the overlapping region is just above the threshold exposure dosage of the negative electronbeam resist. A Si-based nano-dot with two narrow tunnel junctions called single electron transistor was formed after dry etching and thermal oxidation process since the overlapping region is much narrower than the diameter of the nano-dot. The electric characteristic of the SET was found to be consistent with the expected behavior of electron transport through a gated quantum dot. Also, the characteristic phase diagrams of double dot structure were obtained by independently sweeping two gates. The honeycomb lattice of the conductance resonances in the phase diagram was modeled using a capacitance equivalent circuit and the electronic behavior of the double dot device was discussed from measured charging diagram comparing with the model. [C641]

"Research of the field emission of fractal blades patterns of large length"

The looking up of effective, cost-effective (cold) sources of intensive beam couplings is one of actual problems of modern vacuum micro- and nanoelectronics. As far as it is known, the difficulties of deriving of large absolute values of a current of field emission are connected to extremely small values of the effective area of emission component, which forms 10-6to 10-8part from the area of a cathodic substrate. One of methods of increasing of the effective area of emission is the transferring from regular bivariate tips of gratings to surface patterns blade or planar-end configuration with extended fractal boundaries. Apparently, that substantial surface micro- and nanostructure from this or that fraction can be referred to natural fractals. As it was shown, field emission properties of close set film and monolithic carbon patterns on conductive substrates can be essentially improved by a simple vacuum discharge converting 2D pattern with mean values of a period 65-70 nm, altitude 7-8 nm, and radius of curvature of tops 2-3 nm, in discontinuous branching. [C642]

"Lattice of surface-magic-clusters: an ordered array of identical nanostructures"

To create an ordered array of mono-dispersed nanostructure is an important step towards the implementation of nanodevices. The discovery of surface magic clusters (SMC), which refer to clusters exhibiting extraordinary stability at certain sizes on a particular surface, provides a viable pathway for the creation of such an array. The first 2-d lattice of SMC was created and its structure was determined by a combination of scanning tunneling microscopy, low energy diffraction analysis, and ab-inito calculations. [C643]

"Thin relaxed SiGe layers for strained Si CMOS"

High quality, low cost and smooth surface of thin relaxed SiGe layers on new buffers are fabricated. This SiGe nanostructure buffers help thin SiGe uniform layers to relax by introducing some dislocations networks. With these novel Si/Ge buffer, the reduction of thickness of relaxed SiGe uniform layer are from 50 to 75%. The mobility enhancement of the strained Si n-MOSFET deposited on theses relaxed SiGe layer/SiGe buffers are 8 to 40% higher than that of controlled compositional graded SiGe buffers. Such thin relaxed SiGe layers on these new buffers prove to be useful approach to fabricate high quality relaxed epilayers with large lattice mismatch. [C644]

"Magnetic properties of SmCo7 /Co and Sm(Co, Fe)7 /α-(Fe, Co) nanocomposite magnets prepared by magnetic anneal"

In this paper the effect of applying a magnetic field during the crystallization process of mechanically milled SmCo9.5and Sm(Co0.88Fe0.12)9.5alloys on the nanostructure, exchange coupling, and magnetic properties has been studied. There was a noticeable improvement in the intrinsic coercivity iHc, the remanence Br, and the maximum magnetic energy product (BH)maxfor SmCo9.5and Sm(Co0.88Fe0.12)9.5alloys annealed in a magnetic field of 10 kOe were obtained. Better rectangularity of demagnetization curves was also observed for SmCo9.5and Sm(Co0.88Fe0.12)9.5after the annealing treatment. [C645]

"Self-assembly in well-defined block copolymers as a route to novel nanostructured sp2 carbon materials"

This presentation describes two recently developed approaches to electrically active sp2carbon materials ("pi cluster materials") utilizing self-assembly in well-defined block copolymers: i) control of nanostructure in block copolymers of regioregular poly(alkylthiophenes) and ii) synthesis of nanostructured carbon materials through pyrolysis of self-assembled block copolymer precursors containing polyacrylonitrile. The role of copolymer composition and processing conditions in determining the nanostructure as well as some potential applications of resulting materials are discussed. [C646]

"Modifying the nanostructure of Co[CSiO2] samples by controlled annealing"

In this article, on-line measurements of resistance were made on co-sputtered Co[SiO2] 0.65granular films during annealing. The aim was to control the thermal treatment parameters and map the microstructural changes in the sample, and the respective magnetotransport response. [C647]

"Issues in transport"

In this paper, the four examples that complexity of the connection of quantum effects in nanostructure to the properties of devices and integrated circuits. [C648]

"Spatially resolved analysis of carbon-based plasmas in an ICP system"

Summary form only given. We present experimental results on the spatially resolved analysis of carbon-based plasmas for the growth of multiwall carbon nanotubes. First, we compare the 3-D spatially resolved intensity of a pure argon plasma discharge to that of a typical carbon-hydrogen-argon plasma used for nanostructure growth. We then present an analysis of the species present in the carbon-based plasma, identified by a wavelength scan of the plasma from 300-900 nm, to begin to develop an understanding of the possible plasma and growth chemistries. Next, we present 3-D spatially resolved optical intensity profiles versus pressure for the C-C moiety, as this carbon unit is thought to be significant for nanotube growth. The spatial emission of carbon was observed by looking at the 516.5 nm band head of the C2 Swan band. Finally, we present an analysis of the hydrogen rotational temperature versus pressure and temperature versus power. Our measurements indicated gas temperature conditions of about 440-540 K (167-267 °C). [C649]

"TEM characterization for magnetic nano structure processing"

In this article, we discuss practical factors in the application of TEM as part of development of processing of magnetic nanostructures. [C650]

"Room temperature local synthesis of carbon nanotubes"

We report the synthesis of carbon nanotubes (CNT) by localized resistive heating of a MEMS structure in a room temperature chamber. This is the first known vapor-deposition CNT growth method that does not require globally elevated temperatures. The localized, selective, and scalable process is compatible with on-chip microelectronics and removes necessity of post-synthesis assembly of nanostructures to form integrated devices. Synthesized nanotube dimensions are 5-50 nm in diameter and up to 7 μm in length. Growth rates of up to 0.25 μm/min were observed. This accomplishment makes possible the direct integration of CNT devices with on-chip transduction, readout, processing, and communications circuitry, facilitating integration of nanotechnology with larger-scale systems. [C651]

"Manufacturing of two and three-dimensional micro/nanostructures by integrating optical tweezers with chemical assembly"

Optical tweezers have been used as versatile tools for non-contact manipulation of micrometer-sized particles. This paper proposes a hybrid micro/nanoscale manufacturing system using optical tweezers and chemical linkages for fabricating 2D and 3D micro/nanostructures. A holographic multiple trap optical tweezer system is

first used to trap particles in a desired pattern. The particles are then connected to form rigid units using suitable chemistry. Different connection schemes based on gold seeding, complimentary-DNA linkage and streptavidinbiotin chemistry are presented and possible applications of this technique are explored. This method combines the advantages of top-down and bottom-up approaches and is compatible with organic and inorganic materials. [C652]

"Molecular combinatory computing for nanostructure synthesis and control"

Molecular combinatory computing makes use of a small set of chemical reactions that together have the ability to implement arbitrary computations. Therefore it provides a means of "programming" the synthesis of nanostructures and of controlling their behavior by programmatic means. We illustrate the approach by several simulated nano-assembly applications, and discuss a possible molecular implementation in terms of covalently structured molecular building blocks connected by hydrogen bonds. [C653]

"Configurable 3D nanoscale high aspect ratio pillars for surface-enhanced Raman spectroscopy"

Configurable Nanoscale-High-Aspect-Ratio-Pillar (NanoHARP) structures were fabricated by a batch process method. Silver thin films were deposited on the top of NanoHARP to form Raman scattering enhancing substrate. By alternating the NanoHARP fabrication recipe and silver thin film deposition thickness, the density as well as the dimensions of the surface matrix is able to be controlled within a wide range. The results of reflectance spectrum and low-temperature electrical conductivity measurements indicate the non-continuous corrugated Ag surface matrix was formed. The Ag-coated nanopillar structure was utilized as the substrate for Surface Enhanced Raman Spectroscopy (SERS) to detect 1nM Rhodamine 6G sample. The characteristic spectrum of Rhodamine 6G was identified successfully and the Raman signal enhancements were observed to vary within 3 orders of magnitude for different nanopillar structures, which is consistent with theoretical predictions. The controllability of the configurations of nanopillars during fabrication enables us to optimize the nano-structure substrate of SERS for specific biomolecules and thus facilitate the ultra-sensitive biomolecule detections. [C654]

"Patterning Si3 N4 and TiN with scanning probe lithography"

Processes to pattern nanostructures on the Si3N4and TiN films based on scanning probe lithography have been demonstrated. The patterned Si3N4and TiN films were used as etch masks to produce nanostructure on Si substrates. The oxide growth kinetics of both nitride films was studied. The oxide height vs. oxidation period obeys the logarithmic relationship. TiN is superior to Si3N4as etching mask due to its high oxide growth rate and better performance for dry etching. [C655]

"Study of fabricating functional nanostructure through combined with molecular assembly"

In any way, it is difficult to fabricate a functional nanostructure, especially for the research and development of devices. Arranging atoms, molecules to establish a device structure, named the way of bottom-up, represents a direction along which might be with the advantages of low-cost, easy to control and flexible for forming the structure. At present molecular assembly has been found the very important role in the way of bottom-up. The combination of molecular assembly and other fabrication techniques, e.g., lithography, is the first stage of the bottom-up to fabricate the functional structures of devices. Herein we present our efforts to make the electrodes with the feature of nanogap, the preliminary results of the arrangement of nanoparticles within the gap of the electrodes and the assembly of biomolecules on the surface of the electrode. [C656]

"Quantum size effects in nanoscale metallic structures"

Spatial confinement of electrons in a nanoscale metallic structure gives rise to a set of standing wave states and quantized energy spectra. The quantized nature of the electrons and the enhanced boundary scattering could seriously affect the electron transport in future nanoscale interconnects. As revealed by scanning tunnelling microscopy, such quantum size effect also plays a competing role along side the classical thermodynamic effect in the shape relaxation of a metallic nanostructure. In particular, it leads to very unusual mass transport behaviours. Like the electron migration, such effect may have significant impact on the stability of nanoscale metal interconnects. [C657]

"The effect of bias voltage on the measurement of local barrier height"

In this paper a relation among tunnel current, bias voltage and tip-specimen separation is examined based on Simmons' formula under constant LBH assumption. It has the been shown that to understand the effect of bias voltage on LBH, measurement has to be carried out under constant tip-specimen separation, not under constant tunnel current as normally used. Measuring local barrier height with STM is a very powerful way of investigating

surface potential of nano- or atomic structure. [C658]

"TRANSDUCERS '03. 12th International Conference on Solid-State Sensors, Actuators and Microsystems. Digest of Technical Papers (Cat. No.03TH8664)"

First Page of the Article [C659]

"Diffractive optical elements in titanium oxide for MOEMS applications"

We demonstrate a new technology for the replication of titanium oxide glass micro- and nanostructures. Diffractive optical elements, like gratings, and Fresnel lenses with structural features down to 600 nm, are replicated in polymer moulds starting from liquid glass solutions. The salient features of the TiO2microstructures are: a high refractive index (of the order of 1.95-1.99), excellent transparence in the visible range and photocatalytic activity under UV illumination, which induces super-hydrophilicity. The latter property is of importance for anti-fogging and self-cleaning properties of the optical structures. [C660]

"Beyond silicon biotechnology: new routes to structure-directed nanofabrication"

With a precision of nanostructural control that exceeds present human capabilities, marine biological systems fabricate 3-dimensionally organized multifunctional high-performance silicon-based materials at low temperatures and near-neutral pH. Four years ago, we proposed that "silicon biotechnology" could augment traditional routes of high-performance materials synthesis by adapting the proteins, genes and molecular mechanisms governing the biological formation of silicon-based materials in marine organisms. That vision is now becoming a reality. The fundamental molecular biology of silica production in living organisms is now being elucidated, and aspects of these processes are being harnessed for industrially and technologically relevant processes. Working with the silica needles produced by marine sponges, our laboratory discovered that the proteins we named "silicateins" catalyze and structurally direct the polymerization of silica from silicon alkoxides at neutral pH and low temperature. The silicateins are true enzymes, closely related to a well-known family of hydrolases. Site-directed mutagenesis (genetic engineering) of the cloned recombinant DNAs coding for the silicateins has allowed us to confirm the mechanism of catalysis we postulated for the enzymatic polycondensation of siloxanes from the alkoxide substrates, and has been used to increase the rate of catalysis as well. These studies enabled the synthesis of self-assembling "biomimetic" catalysts that incorporate the functionalities we identified as essential for catalysis in the natural enzymes, yielding new structure-directing catalysts of polymerization. The silicateins and their biomimetic counterparts catalyze the structure-directing synthesis from a wide range of precursors, yielding not only silica, but organometallic silsesquioxanes (and other complex organosilicon materials) as well. Most recently, we discovered that the silicateins also catalyze and structurally direct the condensation of alkoxide-like conjugates of metals such as titanium at neutral pH and low temperature. Perhaps most remarkably, molecular recognition results in preferential alignment of the resulting nanocrystallites of the mineral. The result is the first enzyme-catalyzed, nanostructure-directed polymerization of-titanium dioxide. Successful extension to other semiconductors including gallium oxide and zinc oxide recently has been accomplished. Potential uses for electronic applications, sensors, energy transducers, cosmetics and pharmaceuticals are indicated. Encouraged by these results, a major manufacturer and a leading biotechnology firm recently announced a multimillion dollar strategic alliance aimed at the commercialization of silicon biotechnology. Other firms are following. [C661]

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

Three-dimensional nanostructure fabrication has been demonstrated by 30 keV Ga+focused ion beam (FIB) assisted deposition using a hydrocarbon precursor (phenanthrene). Producing of three-dimensional nanostructure is discussed. Micro-coil and bellows with 0.1 μm dimension were fabricated as parts of micro-system. Furthermore, microstructure plastic arts is advocated as a new field using micro-beam technology, presenting one example of micro-wine-glass with 2.75 μm external diameter and 12 μm height. [C662]

"A simple, robust and controllable nano-structures fabrication technique using standard silicon wafers"

We succeeded to realize nano-structures using standard {100} silicon wafers and anisotropic etching; this technique makes use of the low etching rate in TMAH of {111} planes or silicon, in comparison to {100} planes, to adjust the nanometric dimensions of the structures. No sub-micron lithography is required in this technique: it is compatible with normal UV photolithography. Neither complicated process steps are required: a succession of oxidation, oxide patterning and anisotropic etching only are needed. Nano-holes and nano-wires were made using this technique and possible applications of the structures are described for two BIO-MEMS projects. [C663]

"An electrostatic 2-dimensional micro-gripper for nano structure"

We have successfully microfabricated an electrostatically controlled micro gripper for handling nano particles. The gripper has sharp twin tips that can be independently controlled in the XY-plane, and visually confirmed manipulation of a gold particle trapped in between the twin probes. [C664]

"High-sensitive magnetic-field -sensing materials composed of metal/semiconductor hybrid nanostructures"

A huge positive magnetoresistance (MR) effect, about 4 orders of magnitude at room temperature, has been discovered in metal/semiconductor hybrid nanostructures. The hybrid film consisting of metallic nanostructures that are fabricated on a GaAs substrate by ultra-high vacuum deposition method exhibits magnetic-field-sensitive current-voltage characteristics. When a constant voltage, above the threshold value, is applied to the film, very steep change in the current, which we term magnetoresistive switch, is driven by the huge MR effect under a relatively low magnetic field at room temperature. The MR effect is very sensitive to the nanoscale morphology of the hybrid film, in other words, one can control the MR function at will by modifying the nanostructure in this smart system. In this paper, the origin of the magnetoresistive switch effect and the possible application as a magnetic field sensor will be discussed. [C665]

"Technology of ultrasonic finishing treatment for locomotive wheel pair type"

An increase of wear resistance and improvement of tribotechnical properties of wheels of locomotives is an urgent scientific and technical problem. In the forefront are the questions, connected with the improvement of properties of surface wheel flanges and transformation of the surface layer structure. The application of ultrasonic finishing treatment enables to solve the given problem completely. The first stage in the solution of the problem was the research of influence of the ultrasonic treatment on the structure and physical and mechanical properties of the ferrite-pearlite steel wheel and matching optimum modes of processing. Integrated researches of morphology of a surface, macro and microstructure, nano- and microhardness, hardness and wear resistance of wheel tread with ultrasonic treatment, obtained in manufacturing, set outcomes of preliminary researches. The obtained outcomes enabled to offer the given technology for the usage when repairing and producing railway wheel pairs. [C666]

"Correlation between nanostructure and electron emission characteristics of ballistic electron surface-emitting device (BSD)"

The operation of ballistic electron emitters based on nanocrystallised poly-silicon (NPS) films has been analyzed by transmission electron microscope (TEM) and energy-dispersive X-ray microanalyzer (EDX). The results of nanostructural analyses indicate that the existence of interconnected nanocrystalline silicon (nc-Si) is a key factor for the efficient ballistic electron emission. [C667]

"Formation of graphite nanocones using metal nanoparticles as plasma etching masks"

Arrays of graphite nanocones were fabricated by plasma etching of highly oriented pyrolytic graphite (HOPG). Gold nanoparticles, which were used as etching masks, were deposited by immersing HOPG into colloidal gold solution. The shapes and sizes of fabricated nanopillars depended on the plasma etching parameters such as plasma gas, plasma power, and etching time; the choice of plasma gas was important for graphite-nanostructure fabrication in particular. The emission from the pillars fabricated using the oxygen plasma was turned on at 2.3 V/μm, and the emission current density as large as 35 mA/cm2was measured. [C668]

"Numerical study of effects of cellular nanostructure on scattered light"

A three dimensional code for solving the set of Maxwell equations with the finite-difference time-domain method is developed to simulate the propagation and scattering of light in biological cells for realistic conditions. The numerical techniques employed in this code include the Yee algorithm, the absorbing boundary conditions, the total-field/scattered-field formulation, the discrete Fourier transformation and the near-to-far field transform with the equivalent electric and magnetic currents. The code is capable of simulating light scattering from cells with complex internal nanostructures at all angles. The effects of cellular nanostructure on the scattered light are studied. It is shown that changes in cellular nanostructures could cause significant changes in the scattered light at particular angles. [C669]

"Three-dimensional square spiral photonic crystal nanostructures by glancing angle deposition"

We demonstrate the fabrication of a three-dimensional photonic band gap nanostructure using the unique

Glancing Angle Deposition (GLAD) thin film technique. This innovative photonic structure is based on a tetragonal, square spiral symmetry found in FCC and diamond lattices and can be implemented in a virtual single-step fabrication process using GLAD. A highly porous film with engineered nanostructure results from the implementation of advanced substrate motion during the deposition, and three-dimensional periodicity required for a photonic crystal can be obtained when a square spiral staircase is fabricated on a tetragonally seeded substrate. We present successful fabrication of three-dimensional square spiral structures along with some examples of the unique capabilities of these nanostructured thin films. [C670]

"Evaporated nanostructured Y2 O3 :Eu thin films"

Europium-doped yttrium oxide (Y2O3:Eu) is a well-known luminescent material that has been experimented with in recent years in thin film form. However, to date there has not been a great effort put into altering the nanostructure of these films. A thin film deposition technique called glancing angle deposition (GLAD) allows for a high degree of control over the nanostructure of the thin film, resulting in thin films with nanostructures ranging from chevrons and posts to helices. GLAD was used here to make europium-doped yttrium oxide thin films with different nanostructures. Scanning electron microscopy was then used to characterize the nanostructures of the films, while UV excitation was used to characterize the photoluminescence properties of the films. [C671]

"Design of near-field optical nanostructures for enhanced second-harmonic generation"

We present optical nanostructure designs for enhancement of second harmonic generation based on near-field localization and phase matching effects, and analyze these nanostructures using a rigorous electromagnetic modeling tool. [C672]

"Periodic nanostructure formed on TiN and DLC by femtosecond laser pulses"

Hard coatings of TiN and DLC were irradiated by 800- and 267-nm, femtosecond (fs) laser pulses at an energy fluence slightly above the ablation threshold. On the ablated thin-film surfaces, the linearly-polarized fs pulses produce arrays of fine periodic structures that are almost oriented to the direction perpendicular to the laser polarization, while the circularly-polarized light forms fine dot structures. The size of these surface structures is 1/10-1/5 of the laser wavelength and decreases with a decrease in the laser wavelength. [C673]

"Light-soaking stability of nano-structure tailored silicon thin film solar cells"

In order to overcome the light-soaking degradation of hydrogenated amorphous silicon(a-Si:H) solar cells, we have developed a novel material, called nanostructure tailored silicon, where nano-sized crystallites embedded in the amorphous silicon matrix homogeneously. Size and distribution of the crystallites can be precisely controlled by the layer-by-layer deposition. Degradation ratio of standard a-Si:H solar cells, whose degradation ratio is around 19%, can be remarkably suppressed to less than 5%. Although their initial efficiencies are not as high as standard a-Si:H solar cells, their after-light-soaked efficiencies (7.3%) exceed that of amorphous one (6.8%) on non-textured substrate. [C674]

"Drivers for nanotechnologies in Europe"

Drivers for nanotechnology, drivers for innovation, drivers for economic growth. Many people say that the key to anticipating future growth is to first understand the underlying motivation for current trends today. According to this belief, by drawing a line from the past to the present, we are able to predict the future by extrapolation. The now infamous Moore's law is an example of this endless march down the road of technology development. For many years now scientists have been predicting that modern IC production technology has finally reached a limit, some sort of brick wall beyond which Moore's law can no longer hold true. But, keeping in-line with Moore's law, entering the nano-era requires an increasingly significant effort in research and development. The emergence of bottom-up approach to fabrication of structures requires the integration of competencies from many different fields of expertise. Assembling devices one molecule at a time using molecular building blocks requires a skill set not typically found in a traditional semiconductor environment. The new breakthrough technologies will likely result from the integration of applied microelectronics background with more fundamental inputs. And for this, Europe again has specific strengths due to the synergy between national and European level initiatives. [C675]

"High density electron emission from graphite nano-structure fabricated by hydrogen plasma etching and its application to high intensity pulse X-ray generation"

High density electron emission from graphite nano-structure fabricated by hydrogen plasma etching and its application to high intensity pulse X-ray generation were investigated. We introduce a new nanometer-sized tailored cathode that can be made by simple etching of nano-craters onto a graphite substrate. [C676]

"Room-temperature operation of Coulomb blockade fabricated by the nanostructure of self-assembly gold particles utilizing DNA hybridization"

Room-temperature operation of Coulomb blockade fabricated by the nanostructure of self-assembly gold particles utilizing DNA hybridization was investigated. Surface plasma resonance absorption spectra of the gold particle was recorded by a UV-visible spectrometer. [C677]

"CLEO/Pacific Rim 2003. The 5th Pacific Rim Conference on Lasers and Electro-Optics (IEEE Cat. No.03TH8671)"

First Page of the Article [C678]

"Scanning tunneling spectroscopy and photoactivation in WO3 gas sensors"

We collected high resolution scanning tunneling (STM) images on thin films of WO3. This provided information about the morphology and the nanostructure of the samples. The surface gap was then determined through scanning tunneling spectroscopy (STS) and was found to be much narrower than the bulk gap determined via photoluminescence. This effect is a consequence of the high density of surface states in this material. Pinning of the Fermi level due to these states is decreased when the sample is illuminated at low temperature, whereas at high temperature the effect is masked by the high density of free carriers. [C679]

"Evaluation of CdS nanostructures for application to low environmental-load CdS/CdTe solar cells"

The low "environmental-load" CdS/CdTe solar cells for reducing consumption of Cd compounds have been investigated employing the CdS layers fabricated at various substrate temperatures, T/sub CdS/. The nanostructure of CdS crystallites made at different T/sub CdS/ are compared to the crystallinity of CdS, and CdTe deposited on CdS as well as sulfur fraction in CdTe/sub 1-x/S/sub x/ mixed crystal layer unintentionally formed at CdS-CdTe(S) interface. To obtain relative high V/sub oc/, high crystallinity is required for CdS, while to prevent the degradation of CdS/CdTe(S) interface for keeping high FF, rather CdS with low crystallinity is suitable. To break the contradictional requirements for CdS crystallinity, a novel technique is introduced, i.e., (CH/sub 3/)/sub 2/SnCl/sub 2/ (DMTC) doping into CdS. The large sulfur fraction in CdTe/sub 1-x/S/sub x/ mixed crystal layer being a degree of the CdS/CdTe(S) interface is obtained in the solar cell employing the CdS layer doped with DMTC even when the DMTC-doped CdS layer obtains high crystallinity. So far, we have achieved 14.8% efficiency of the low environmental-load CdS/CdTe solar cell. [C680]

"Low-temperature processing of photoelectrochemical solar cells"

Photoelectrochemical (or Gratzel) solar cells are normally manufactured by a process involving a sintering heat treatment of the TiO/sub 2/ photoanode, to provide mechanical and electrical contact between the nanoparticles. This precludes the use of many low cost substrates and alternative manufacturing approaches. This paper describes a new approach to engineer the nanostructure such that the heat treatment step can be eliminated whilst retaining acceptable device performance. The principles of and processes used to facilitate this are described and the device characteristics reported. [C681]

"Nanostructure characterization of nanocrystalline Si thin films by using small angle X-ray scattering (SAXS)"

Nanocrystalline Si (nc-Si) films attract special interest from the point of view of the possibility of higher conversion efficiency compared to amorphous Si films. To investigate this possibility, it is necessary to know the nanostructure such as mean diameter and size distribution. Until now, transmission electron microscopy (TEM) and Raman analysis are used for this purpose. However, these methods have problems in determining the size; the observed region of TEM is restricted to several hundred nanometer, and the size was estimated based on a strong confinement model for Raman analysis despite the fact that the validity of this model has not been proved yet. In this paper, we report the determination of the average diameter and the size distribution of nc-Si films by using small angle X-ray scattering measurements (SAXS). We found that the model of Raman analysis used until now is not appropriate to determine the size of nanostructure. Based on SAXS results, we show a correct relation between the average diameter and the peak shift of Raman spectrum. [C682]

"Novel applications for surface plasmons in photovoltaics"

Recently discovered novel effects that occur when light interacts with metallic structures around its own wavelength offer a range of interesting possibilities for photovoltaics. Excitation of nanoscale metallic structures

leads to oscillation of the conduction electrons, known as surface plasmons. The possible uses for surface plasmons in photovoltaics include improved absorption of light for very thin films, improved light emission for thermophotovoltaics and thermophotonics, and enhancement of the efficiency of frequency conversion materials. In this work the potential for surface plasmons to improve photovoltaic conversion efficiency is discussed and a simple technique for the fabrication of metallic nanostructures is demonstrated. [C683]

"Preparation and thermal transport properties of CoSb3 nano-compounds"

CoSb3micrometer powder was synthesized by solid-state reaction using high purity powder of Co, Sb as the starting materials. CoSb3nano-powder and block material with nanostructure were prepared by high-energy ball-milling and by Spark Plasma Sintering (SPS), respectively. The influence of mass ratio of big balls and small balls, milling speed and time on particles size of CoSb3powder, and sintering temperature and time on grains size of CoSb3were investigated. The influence of nanostructure on thermal transport properties of CoSb3was also studied. [C684]

"Creating microbeams and nanobeams by channeling in micro- and nano-structures"

A particle beam of very small cross-section is useful in many accelerator applications including biological and medical ones. We show the capability of channeling technique using a micron-sized structure on a surface of a single crystal, or using a nanotube, to produce beam of a cross-section down to 1 square micrometer (or nanometer). The channeled beam can be deflected and well separated in angle and space from the primary and scattered particles. According to our Monte Carlo simulations of channeling and experience with crystal channeling at IHEP (Protvino), emittances down to 0.1-0.001 nanometer-radian, and flux up to 1 million ions per square micron per second, can be achieved for protons and ions in the range 0.1-3 GeV/u. We discuss the experimental techniques to achieve suitable structures for particle beam channeling. [C685]

"Broadband antireflection for III-V semiconductors by subwavelength surface grating structures"

Recently, it is demonstrated that the subwavelength grating (SWG), which is the surface-relief grating with the period smaller than the wavelength of light, behaves as an antireflection surface. In particular, a tapered SWG suppresses reflection over a wide spectral bandwidth. The SWG is more stable than the multilayered thin film, since it is fabricated from a single material. In this study, we demonstrate broadband antirefraction properties of III-V materials (GaSb) by using SWG. The surface nano-structures with 200-350 nm periods are fabricated by means of electron beam lithography and fast atom beam (FAB) etching. The reflectivity of the sample is strongly suppressed from the visible to near IR region. The experimental data is compared with numerical simulations using the rigorous coupled analysis (RCWA). [C686]

"Paramagnetic nanostructures in photorefraction"

The paper is on the properties of a photorefractive ion determined by ions of a lattice of a ferroelectric crystal. They determine magnitude and orientation of the electrical dipole moment of an impurity, and an influence on orientation of a magnet dipole moment. Thus, it allows characterizing such formation as paramagnetic nanostructure with the proper electrical dipole moment, directional along an optical axis of a crystal, and magnetic dipole moment, casually oriented in a crystal. The photoionization changes the parameters of a paramagnetic nanostructure that superimposes particular restrictions on directions of impulse of a photoelectron in a crystal. [C687]

"Parallel multi-scale computation using the message passing interface"

A sequential three-dimensional hybrid molecular-dynamics (MD)/finite-element (FE) code to perform continuum and atomistic multi-scale modeling and computation, has been parallelized using the message passing interface (MPI) library. A master-slave divide-and-conquer approach, emphasizing the functionality and robustness of the code, is implemented through loop parallelism and has reduced execution time: yielding a speedup of greater than 3 and has shown potential for further speedup. The smoothness of the stress distribution across the overlapping region between the continuum domain and the atomistic domain demonstrates the suitability of this method to nanostructure modeling. [C688]

"Synthetic gecko foot-hair micro/nano-structures for future wall-climbing robots"

This paper proposes techniques to fabricate synthetic gecko foot-hairs for future wall-climbing robots, and models for understanding the synthetic hair design issues. Two nanomolding fabrication techniques are proposed: the first method uses nanoprobe indented flat wax surface and the second one uses a nano-pore membrane as a template. These templates are molded with silicone rubber, polyimide, etc. type of polymer

under vacuum. Next, design parameters such as length, diameter, stiffness, density, and orientation of hairs are determined for non matting and rough surface adaptability. Preliminary nano-hair prototypes showed adhesion close to the predicted values for natural specimens. [C689]

"Control of charging in high aspect ratio plasma etching of integrated circuits"

In this paper we discuss some recent studies on control of charging during plasma etching of silicon dioxide in integrated circuits. These are required to reduce the damage on the devices and allow further increase in speed and capacity of integrated circuits. Such possibilities have a bearing in development of telecommunications. In particular we discuss how properties of incoming ions, geometry of the nanostructure, aspect ratio and plasma properties affect the kinetics of charging. [C690]

"Thin films induced by nanometric powders flotation"

Different kind of nanometric powders: carbon,iron, titanium oxide or composites like: Fe/Ti, C/Fe, were obtained by laser pyrolysis of some specific precursors. All of these powders have the ability to float on water. In a good analogy with Langmuir-Blodgett deposition technique, thin film of pyrolytic nanoparticles were realized. Special properties and future applications of them were exhibit. [C691]

"Toward large nanostructures"

We describe here the enzymatic production of unusually long sequences of DNA with structural significance for nanostructure self-assembly. A circular template is generated via enzymatic cyclization of a 95 base linear oligonucleotide which then serves as a substrate for DNA polymerases. these 95mer-circles are efficient templates, leading to the production of tandem repeat strands as long as 15,000 bases. Our studies further demonstrate the repetitive nature of the product by enzymatic cleavage giving unit-length oligonucleotides. The rolling circle amplification technique presents a useful method for generating well defined, macroscopic components of DNA nanostructures. [C692]

"Semiconductor photonic crystal nanostructure"

Photonic crystals are expected to realize various novel performance and functions in photonic devices, such as ultralow threshold lasing in nanolasers, high efficiency light extraction from LEDs, flexible optical wirings by ultrasmall waveguide elements, unique light localization and radiation in defects, high resolution filtering and wide angle deflection of light by the superprism phenomenon, and strong nonlinear response by an ultrasmall group velocity of light at a photonic band-edge. All these have been theoretically investigated and partly demonstrated in the experiment. Most popular structures in the experiment are the photonic crystal slab as a 2-D crystal and the woodpile structure as a 3-D crystal, both of which are fabricated by simple MEMS technologies. [C693]

"Quantum-dot cellular automata: an architecture for molecular computing"

The quantum-dot cellular automata (QCA) paradigm is a revolutionary approach to molecular-scale computing which represents binary information using the charge configuration of nanostructures in lieu of current switching devices. The basic building-block of QCA devices is the QCA cell. Electrostatic interaction between neighboring cells allows the design of QCA wires, logic devices and even simple microprocessors. The geometry of molecular six-dot QCA cells enables the clocking of QCA devices via an electric field generated by a layout of clocking wires. Thus, precise control over the timing and direction of data flow in QCA circuits is possible. The design of QCA circuits now lies not only in the logic structure of the cells, but also in the layout of clocking wires. We discuss the clocking of QCA devices and connect layout to architecture. [C694]

"Proceedings of CAOL'2003. 1st International Conference on Advanced Optoelectronics and Lasers. Jontly with 1st Workshop on Precision Oscillations in Electronics and Optics (IEEE Cat. No.03EX715)"

The following topics are dealt with: laser biomedicine and chemistry; physics and engineering of nanostructures; nonlinear, singular optics and fiber optical vortices; optical communication; optical measurement techniques; organic coherent optics; crystal resonators theory; crystal oscillators theory and noise; and timekeeping and applications [C695]

"Multistable nematic liquid crystal device using nanoscopically patterned surface alignment"

The introduction of nanostructures in otherwise homogeneous liquid crystals can potentially be a powerful approach to create naturally nonexistent phases, structures and functions based on the liquid crystallinity. Owing

to the microscopic molecular orientational order and the associated long range curvature elasticity, indigenous liquid crystal structures interact strongly with extrinsic objects on the nanometer scale. Here, we present the results of our recent efforts along the directed bottom-up approach as applied to artificial two-dimensional nanostructuring of liquid crystals with a view to developing novel photonic devices. We will focus here on the use of the stylus of the atomic force microscope to nanoscopically treat the surface anchoring in such a way as to implement an orientationally patterned surface. Theoretical analysis shows that the threshold voltage remains at most twice that for the bistable device, no matter how large the degree of multistability becomes. [C696]

"Nanophase materials, nanotechnology and nanoelectronics: cluster substances in molecular electronics"

Characteristics of nanostructured materials are discussed. The results of fabricating and studying molecular nanostructures are given. The possibility of producing single molecule-based nanoelectronic devices is demonstrated. [C697]

"Nanostructured aluminium-diamond composites for thermal management applications"

The nanostructure and morphology of Al-diamond composite material produced by pressurised liquid metal infiltration have been studied. These composites may have the potential for applications in the thermal management and electronic packaging industry. The composite samples produced by using nanosized diamond powder were examined by using advanced analytical techniques. It was demonstrated that the liquid metal infiltration technique was suitable for the production of Al-diamond composites. The samples revealed more uniform dispersion of diamond particles. Occasionally plate-shaped Al4C3particles formed at the interface between Al and diamond particles were also detected. It can be suggested that these carbides may have formed in association with the ultra-thin amorphous graphite layer at the interfacial region. [C698]

"Designing for beam propagation in periodic and nonperiodic photonic nanostructures: extended Hamiltonian method"

In this work, we have demonstrated the use of Hamiltonian optics to design and analyze beam propagation in 2-D periodic and nonperiodic photonic nanostructures with slowly varying nonuniformities and also we have extended the Hamiltonian optics method to analyze the width of the beam propagating in these structures. We validated our method with finite difference time domain (FDTD) simulations, and designed a 2-D nonuniform structure that functions as a flat-top frequency demultiplexing device, which steers beams in two different frequency ranges to two different locations. [C699]

"Proceedings of CAOL'2003. 1st International Conference on Advanced Optoelectronics and Lasers. Jontly with 1st Workshop on Precision Oscillations in Electronics and Optics (IEEE Cat. No.03EX715)"

First Page of the Article [C700]

"Laser-plasma interaction in the resonator at the nanostructuring of solid surface by 0.69-μM laser"

The temporal shape of ruby laser pulse is experimentally investigated in the cavity typical for the intracavity processing of Al-film evaporated on the glass substrate. This results in forming of the train of nanosecond pulses with nearly 100% modulation. It is shown the possibility to form nanosized periodic surface structures by single-pulse ruby laser treatment [C701]

"Quantum- and nano-structure semiconductors for ultrafast photonic devices"

In this paper, we review some of the progresses in quantum- and nano-structure semiconductor devices with a particular focus on femtosecond all-optical switches based on intersubband transition in quantum wells (QWs) and ultrafast quantum dot semiconductor optical amplifiers (QD-SOAs). [C702]

"Research on annealing temperature in the process of MoS2 nanostructure synthesis from nanoscale powder"

To see the formation process of inorganic fullerene-like structures from MoS2the thermal annealing of superfine nanoscale MoS2powder was performed in neutral argon atmosphere. The grain size of MoS2powder is about 3 nm. The annealing temperature varied in the range of 500°C-1000°C, and the annealing time varied between 4 hours and 5 minutes for low and high annealing temperatures, respectively. PXRD and TEM analyses were made to observe the change of the character of the crystallization process and of the curvature of [002]

MoS2planes. The rise of the annealing temperature leads to an increase of the crystalline phase and a simultaneous decrease of the amorphous phase in the MoS2powder. The sample annealed at Tann=500°C reveals a weak curvature of the [002] planes, and the grains become larger as compared with the pristine MoS2powder. Increasing the annealing temperature up to Tann=700°C leads to a stronger curvature of the [002] planes. The character of the curved planes varies from quite large planes with a large curvature radius up to U-shaped and rectangularly shaped structures. An increase of the annealing temperature up to Tann=1000°C, finally, leads to a pronounced crystallization of the powder, with some part being left over in an amorphous phase. [C703]

"High frequency performance of Sb-heterostructure millimeter-wave diodes"

We have developed a new zero bias millimeter wave diode based on quantum tunneling in an InAs/AlSb/GaSb nanostructure. It is ideal for square law radiometry and passive millimeter wave imaging. Excellent sensitivity has been demonstrated at present up to 110 GHz, with higher bandwidth predicted for smaller area diodes. [C704]

"Defect-tolerant molecular electronics"

The integrated circuit, manufactured by optical lithography, has driven the computer revolution for three decades. If we are to continue to build complex systems of ever-smaller components, we must find a new technology that will allow massively parallel construction of electronic circuits at the atomic scale. Our Hewlett-Packard and University of California research team is currently developing the molecular electronics building blocks and computer aided design algorithms for a defect-tolerant reconfigurable architecture which allows one to electrically download the designed complexity of a computer into a chemically assembled regular but imperfect nanostructure [C705]

"Optical enhancements on gold thin films through surface nanostructure modulation"

Surface plasmons (SPs) on gold thin film coupling with the grating on the surface were studied. For films with periodic nanostructures, experimental results and simulations showed that the incident light was reflected as well as excited. Because the propagating wave is particular about the surface plasmons excitation, we used the FDTD simulations to predict the grating conditions such as the thickness, period, width, and depth. Optical transmission intensity enhancements due to the nanostructures on the gold thin films were observed in our results. [C706]

"Sensors based on nanomaterial of biological origin"

The authors select bacteriorhodopsin (BR) nanomaterial for sensor applications. For small molecules, the optical phase variation over the dimensions of the molecule cannot be neglected in the analysis of the optical activity (OA), explaining the high sensitivity of OA to molecular structure changes. The BR nanomaterial used presents light-dependent proton pumping of halobacteria and includes two functions: first, it can be observed as an actuator generating H+on the cell membrane. At the same time its is able to play the role of photoreceptor (sensor), and this function is connected with its proton transportation activity. Together with this, there is a mechanism, which, guided by a control signal from outside, can manipulate protons. Thus, they have a functional device of biological origin, expressing features of the proton-nanostructure interaction. [C707]

"Energy structure and magnetization effect of semiconductor quantum rings"

In this paper, we study the electronic structure of InAs/GaAs quantum rings and dots under applied magnetic fields. To compute electron-hole energy states and magnetization, a realistic three-dimensional (3D) model is applied and is solved with the nonlinear iterative method. With the developed nanostructure simulator, the variation of energy states for semiconductor quantum rings (Rin=10 nm) changing into dots (Rin=0 nm) are investigated comprehensively. For a fixed ring height and width, we have found the energy band gap of rings are strongly dependent on ring (and dot) shapes, ring inner radii, and applied magnetic fields. Due to the magnetic field penetration into the ring region, the variation of electron-hole energy states and magnetization of InAs/Gas rings saturate and oscillate nonperiodically when the magnetic field increases. Our observation in the oscillation of electron-hole energy states is contrary to conventional periodical argument. The results presented here provide an alternative in studying optical spectra and magneto-optical property of semiconductor quantum rings and are useful for real device applications. [C708]

"Dispersive photonic crystal dispersion and its photonic applications"

Photonic crystal has emerged as a new class of photonic materials capable of on-chip localization and manipulation of light. These effects are based on the existence of a large, absolute photonic band gap (PBG)

and are expected to impact highly efficient active devices (such as lasers and LEDs) as well as miniaturized passive devices (such as guides, bends, splitters) applications. More recently, it is realized that photonic dispersion away and near the PBG regime exhibits many interesting optical properties. In particular, its anisotropic, nonlinear and birefringent property can all be tailored through nano-structure engineering. This design flexibility is a very attractive feature for realizing integrated optical and optoelectronic chip. In this talk, examples of such a new class of photonic devices will be described. Near a photonic band edge, the frequency-wavevector dispersion is very nonlinear, which can lead to a highly dispersive prism. The slow down in speed-of-light at the band edge may enhance material absorption by order-of-magnitude. Interesting application of this effect on light-emitting devices and inter-subband based devices will be discussed. In the allowed band spectral regime, there exists a large birefringent effect, yielding an efficient and compact polarizer and rotator. [C709]

"Image processing with quantum dot nanostructures"

Image processing capabilities of a quantum dot nanoelectronic device structure are investigated. The device characteristics are compared with the cellular neural network model and system equations are presented. Certain characteristics of the device are demonstrated via simulations of the resultant dynamical system. Image smoothing, edge detection, and noise reduction capabilities of the nanostructure are presented and a discussion of the results generated by simulation examples is given. [C710]

"Magnetic nanostructure fabrication by focused ion beam milling"

Summary form only given. Magnetic nanostructures with sub-100 nm features are usually fabricated by e-beam lithography but the process involves several steps and can be time inefficient in the production of small numbers of development samples. We report here the use of focused ion beam (FIB) milling to directly pattern ferromagnetic thin films as a rapid method of fabricating nanostructures. 5 nm thick, thermally evaporated Permalloy (Ni80Fe20) films were patterned with 30 keV Ga+ions. The FIB spot diameter was 10 nm and, after milling depth calibration, an ion dose density of 11 cm-2was used to ensure the complete removal of Permalloy at milling sites. [C711]

"Giant tunneling magnetoresistance in polycrystalline nanostructured Znx Fe3-x O4 -α-Fe2 O3"

Summary form only given, as follows. Giant tunneling magnetoresistance effect (TMR) as large as 1280% at 4.2 K and 158% at 300 K was observed in Zn0.41Fe2.59O4-α-Fe2O3polycrystalline sample. The Zn0.41Fe2.59O4grains are separated by insulating α-Fe2O3thin layer boundaries. The nanostructure pattern has been verified by TEM and HREM and the thickness of α-Fe2O3boundary is about 6-7 nm. The huge TMR is attributed to the high spin-polarization of Zn0.41Fe2.59O4grains and the insulating antiferromagnetic α-Fe2O3thin layer. The conductivity is found to depend exponentially on reciprocal temperature that means the electronic transfer is dominated by thermally activated tunneling from grain to grain. The ZnxFe3-xO4ferrite is a new type half-metallic material and the huge TMR at room temperature is a new breaking advance. [C712]

"Permanent-magnet properties of FePt, FePt:Fe and FePt:Co nanocomposite films"

Summary form only given. The high anisotropy of face-centered tetragonal FePt, about 6.6Ч107ergs/cc, makes it a good candidate for hard-soft permanent-magnet composites with high energy products. In the present work, we prepare and characterize thermally processed FePt/Fe and FePt/Co multilayers and investigate the hysteresis loops of the partially textured hard-magnetic materials and its relationship to the nanostructure of the films. [C713]

"Nanostructured cores with extremely low loss and controlled permeability"

Summary form only given. Recently, the size reduction of magnetic components such as choke coils and linear inductors is strongly needed for the miniaturization of electronic devices. Although ferrite cores with air-gaps have been widely used for this purpose up to now, small saturation magnetization and leakage flux from air-gaps have prevented a further size reduction of magnetic components. This contribution reports that toroidal cores for choke coils with extremely low loss were developed from nanostructured FeCuNbSiB ribbons. The relative permeability of the cores was set to approximately 250 by using the creep-induced anisotropy. Deterioration of magnetic properties due to formation of a toroidal core was suppressed by controlling the core diameter and/or magnetostriction. Resultantly, the permeability of the developed cores was kept constant up to 1 MHz. The magnetic loss was much smaller than the loss values reported previously for nanostructured and amorphous cores with low permeability, and agreed with the calculated classical eddy current loss. As for DC-bias properties, the permeability and magnetic loss were kept constant up to the DC-bias field being three times higher than that applicable to a ferrite cut core with the same permeability value. These superior magnetic properties can be attributed to the large saturation magnetization and magnetization process due to rotation of

magnetization as well as the nanostructure of the cores. [C714]

"Photoluminescence of porous silicon and porous polysilicon films"

We conducted a series of experiments on porous silicon (PS) and porous polysilicon (PPS) to investigate the origins of photoluminescence in these materials. A study of the effects of surface layer plasma etching, for several different durations, on the as-anodized samples was conducted. For the photoluminescence (PL) study, results show that the intensity decreases rapidly, but the peak locations remain fairly unchanged, as the surface etching proceeds. In addition, only one band centered at around 680 nm (1.82 eV) is found in the PS samples whereas two bands, centered at 400 nm (3.1 eV) and 680 nm, are found in the PPS samples. The 400 nm peak disappears when the surface oxide layer was completely removed. These results could not be explained with the quantum confinement model of silicon nano structures. We ascribe these PL effects to the radiative centers in the surface oxide layer. Fourier transform infrared (FTIR) measurements on these samples further reveal that the PL peak at 680 nm correlates well with the NBOHCs (non-bridged oxide hole centers or ≡-SiO·) and the 3.1 eV peak can also be attributed to the oxygen vacancy (≡Si-Si≡) in the surface silicon oxide layer. [C715]

"Magnetic properties and microstructure of Co/C multilayer films"

Summary form only given. Nanocomposite Cobalt-Carbon and Cobalt alloy-Carbon films show great application potential due to their unique structures and physical properties. By tuning the microstructures and composition, they can be used either as magnetic recording media or as soft magnetic materials. Recently, patterned magnetic nanostructure was fabricated using nonmagnetic Co-C thin film via phase change method. To better understand the phase-changing process and further improve the magnetic properties of such fabricated pattern, it is warranted to study its magnetic properties and microstructure as function of annealing temperatures and composition in detail. In this paper, a series of Co/C multilayer films were prepared and their magnetic properties and microstructures were studied detailedly. [C716]

"Direct magnetic patterning of non-magnetic Co/C thin films by electron-beam radiation"

Summary form only given. Conventional electron beam lithography (EBL) has been used for fabricating patterned nanostructure, however, it involves the cumbersome process of resist coating, etching, lift-off, etc., which greatly complicates the production of patterned nanostructures. Mask-assistant ion beam mixing of multilayer films has been proposed but demonstrated low-resolution. A novel method involving direct magnetic patterning of a non-magnetic film by e-beam radiation induced nano-scale phase change is proposed in this paper, and preliminary results are presented. Metastable amorphous Co-C thin films were selected for this study. [C717]

"Fabrication of flat electrodes with nano-gaps using cluster ion beams"

Recently there has been of considerable interest in developing molecular electronic devices by utilizing the ability of self-assembly to form a fixed structure. In order to evaluate electronic properties of molecular devices, it is required to make flat electrodes in which the surface of electrodes is almost parallel to that of insulating substrate, since steps between electrodes and substrates prevent from constructing a self-assembly nanostructure. We herein report fabrication processes of flat electrodes whose spacing are about 100 nm, using electron beam lithography and argon gas-cluster ion beams. [C718]

"Three-dimensional nanoimprint using a mold made by focused-ion-beam chemical-vapor-deposition"

Nanoimprint lithography (NIL) is a very useful technique by which the fabrication of various nanostructure devices. A conventional mold is delineated by EB lithography and dry etching which has usually two-dimensional (2-D) patterns. 3-D structures are required in various devices such as optical devices (micro-lenses, photonic crystals, etc.). FIB-CVD is very useful to fabricate 3-D structures, as we previously demonstrated with several 3-D nanostructures. Moreover, a very large Young's modulus over 600 GPa were confirmed by observation of diamond-like carbon (DLC) pillar mechanical vibration. These characteristics are advantageous to make 3-D mold. In this paper, we will report 3-D NIL using DLC mold by FIB-CVD. We used a commercial available FIB system (SMI9200: Seiko Instruments Inc.); a 30-keV beam of Ga ions was focused on the substrate, which was in a precursor ambient. We used phenanthrene (C14H10) as the source gas for the amorphous DLC growth. [C719]

"Distributed feedback lasers having quantum-wire array as an active grating"

Integration of semiconductor nano-structures (NS) with conventional optoelectronic devices is important to draw technical breakthrough in their performance. One of the interesting examples in semiconductor lasers is realizing

a gain-coupled distributed-feedback (GC-DFB) laser using V-groove quantum-wire (QWR) arrays. In this paper we have tried to get GC-DFB lasers to operate at room temperature (RT) by (1) eliminating the process for grating overgrowth and (2) modulating the QWR active grating profiles. [C720]

"Nanoimprint lithography-A key "engine" to nanotechnology research and commercialization today"

Nanoimprint lithography (NIL) has increasingly been recognized as a key nanomanufacturing technology that will play a critical role in commercialization of nanostructures. In this talk, we will overview the development of NIL technologies (machines, masks, resists, and processes) and applications in the NanoStructure Laboratory at Princeton University. [C721]

"Solid phase graphitization of amorphous carbon pillars grown by FIB-CVD"

We will report the solid phase graphitization of amorphous carbon nanostructures grown by chemical vapor deposition with focused ion beam (FIB-CVD). We previously demonstrated with several three-dimensional nanostructures, i.e., wine glasses, coils, and pillars. We found the solid phase graphitization was induced by iron catalyst, remaining the original 3D shapes. [C722]

"Nanophotonics: the breakthrough technology to control nanostructure by photons with near field and nonlinear optics"

Summary form only given. The minimum size of the light spot generated with traditional optics is around a half micron. In this presentation, I will show how we can exceed this limitation due to the diffraction of the light with an evanescent photon, which has an imaginary momentum component to tunnel in the near field between nano-probe and nano-structure. Nonlinear response of the material to photon intensity can be also used for super-resolving imaging. I will show our experimental results from our developed near-field Raman imaging/spectroscopy, coherent anti-Stokes Raman microscopy, and two-photon photo-polymerization and photo-isomerization for fabrication, manipulation and observation of nano structures. [C723]

"3D imprint lithography using Six Ny molds"

Three-dimensional patterning reduces more complicated alignment steps in the fabrication of micro and nano-scale structures. Multiple lithography processes with interlevel alignment or single lithography with multi layer resist is essential for three dimensional patterning. A number of 3D structures have found immediate applications in a range of microelectronic systems such. as micro-optics, micro-electromechanical systems, and in monolithic microwave integrated circuits. We have previously demonstrated that imprint at low temperatures (well below the glass transition of the resist) is possible for a number of structures using silicon nitride (SixNy) molds. A low temperature process is important for pattering substrates or polymer-based materials that are intolerant of high temperatures. The advantages of using SixNyfor mold making are the capability of forming reliable nanoscale structures and its surface properties that allows imprint without sticking. In this work we will present pattering results for three-dimensional structures using nanoimprint lithography with SixNymolds. The mold material consists of a 1μm thick low stress SixNylayer deposited by low-pressure chemical vapour deposition (LPCVD) on to a silicon substrate. Patterning of the SixNywas performed using electron beam lithography at 50keV into ma-N 24033 negative tone resist. [C724]

"Control and signal processing for photoresist processing in microlithography"

The lithography process is a critical step in the fabrication of nanostructures for integrated circuit manufacturing. In this paper, a summary is presented of several projects applying control and signal processing techniques to lithography. We begin with a presentation of a nonoptical lithography process under development in our lab. The proposed lithography technique is based on chemically altering the surface in a spatially selective manner to achieve a patterned substrate. In addition to the exposure step, photoresist processing is also critical in lithography. Based on current limitations of photoresist thermal processing system, a new integrated system is designed to improve the performance of temperature sensitive chemically amplified photoresists used in deep-UV lithography. Two case studies where control and signal processing techniques have made an impact in photoresist processing are also presented. [C725]

"Raman and FTIR studies on nanostructure formation on silicon carbide"

We report experimental results following studies on the defects induced by light and heavy high-energy ion implantation into 6H p-type and n-type silicon carbide, as well as the degree of crystalline lattice recovery after annealing in high purity argon environment at 1100 and 1600°C. We implanted silicon carbide with MeV Au and Al ions at levels of 1016and 1017ions/cm2, and used confocal micro-Raman (MR) and Fourier-Transform Infra-

Red (FTIR) optical spectroscopy techniques to characterize the silicon carbide lattice optical properties at various stages during the post-implantation annealing process. We also investigated the conditions for metallic nanoclusters formation following the destruction of the lattice during the ion implantation and influence of the thermal treatment on their evolution. [C726]

"The electron temperature in nanostructures subjected to a high electric field"

The drift-diffusion characteristics that limit the drift velocity to thermal velocity, appropriate to the dimensionality of nanostructures, are described. The concept of a hot electron and its temperature in a given context is discussed and simple analytical expressions extracted. These contextual definitions include: energy temperature, mobility temperature, Einstein-relation temperature both under ac and dc conditions, quantum temperature, and two-band intrinsic temperature. The dependence on the electric field is given in each case and the role of electric-field-induced quantum emission is delineated. [C727]

"Microscopical characterization of nanocapsules templated on ionic crystals and biological cells towards bio-medical applications"

Nanocapsules represent a comparatively new class of colloids with controlled nanostructure. The use of crystals as core influences the wall texture and the properties of the capsules. Yeast cells constitute a candidate as core. They are a good system for testing the protective ability of shells and the permeability of the walls with respect to the needs of biological systems, namely: feeding and stability against attacks. The main features of the nanocapsules have been studied by two-photon, confocal and atomic force microscopy. Nanocapsules are of bio-medical interest since they can be used, for example, for the controlled release and targeting of drugs as well as for the protection of enzymes, proteins and foreign cells. [C728]

"Characteristics of InAs "dots-in-a-graded-well""

A number of studies have now established that the use of (In,Ga)As quantum-dot nanostructures in active regions of infrared detectors and lasers has desirable effects on some key characteristics of these devices. Intersublevel quantum-dot infrared detectors, for example, can detect normal-incidence light, unlike quantum-well detectors which operate under the similar principles. Quantum-dot lasers with a range of desirable properties such as ultra-low threshold current densities, low sensitivity to temperature variations, and long wavelength (1.3 μm) emission have been demonstrated. In lasers, however, the quantum-dot media do not often have sufficient gain for the structures to lase at the ground state. This paper explores a structure that could potentially be used to enhance the gain in quantum-dot active media. [C729]

"Self-assembled nanoholes by molecular beam epitaxial growth and atomically precise in situ etching"

Manipulation of nanostructure based on quantum dot (QD) is feasible by applying in situ etching technique. We report a systematic investigation of an in situ etching procedure of capped InAs QD. The AsBr3in situ etching gas produces nanoholes in the GaAs capping layer due to the strain enhanced etching rate on the top of QD. These hole structures can be filled with InAs again to produce lateral QD molecules in the second layer. [C730]

"High-sensitivity sensor of low relative humidity based on overlay on side-polished fibers"

A low relative humidity sensor based on overlay on side-polished-fiber is presented. The evanescent field from a single-mode optical fiber is coupled to a TiO2waveguide overlay. The transmission response exhibits sharp resonances whose central wavelengths are linearly shifted with relative humidity. This behaviour is due to the porous columnar nanostructure of the TiO2film. The water is adsorbed in the pores of the nanostructure changing the refractive index of the layer and causing a shift of the wavelength resonances. The response of the sensor is determined by the shape and size of the pores. The optical fiber evanescent field sensor developed has a linear response and high sensitivity (0.5 nm/% RH) for low-relative humidity (RH-0%-15%) at 26.1°C ± 0.6°C. The lack of hysteresis in the adsorption-desorption cycle has been checked. Finally, the development of sensor with tailored response is envisaged using techniques to control the porosity of the material. [C731]

"Large pure refractive nonlinearity of nanostructure silica aerogel at near infrared wavelength"

The nonlinear refraction coefficient of the third-order susceptibility of silica aerogel was estimated to be -1.5Ч10-15m2/W (-3.67Ч10-9esu) by a signal-beam z-scan technique with 1 ps Ti:sapphire lasers. The third-order nonlinear refraction coefficient of nanostructure silica aerogel is almost five orders larger than the nonlinear ($\chi 3$) refraction of bulk material. The large nonlinear refraction originates mainly from the direct excitation to the surface trapped states, and the one-photon resonance process. [C732]

"Eigenmode analysis of optical propagation in large-scale subwavelength periodic nanostructures"

Summary form only given. We describe a method for rigorously computing the mode characteristics of a periodic nanostructure, and its application to the accurate design of composite optical materials and novel optical devices. In a form-birefringent nanostructure such as a 1D subwavelength periodic grating, the different field distributions for the two linear polarizations result in different effective indices of refraction. Thus the effective optical properties may be engineered through the structure geometry and choice of constituent materials. Engineering of the propagation characteristics of the eigenmodes in a nanostructure can also be used to realize novel photonic devices, such as to achieve phase matching for second harmonic generation (SHG). [C733]

"Diffusion and defect formation in ion implanted Si nanostructures"

Simulations and measurements of ion implantation and diffusion in 20-200 nm Si nanostructures have been carried out. Simulations predict a reduction in transient enhanced diffusion with decreasing nanostructure dimensions and a non-uniform diffusion front. SIMS measurements provide useful information in the near surface region, but for deeper profiling, detailed modeling is required. TEM shows the presence of extended defects in structures as small as 40 nm. [C734]

"Cell-silicon-hybrids for biomedical analysis and bioinformatics"

Summary form only given. Cells are the "atoms" of all living systems. Their nanostructure consists of electrodynamic components (membranes) involved in cellular signal transduction. Frequency modulated ion currents (Ca2+oscillations) induced by extracellular molecular "messages" encode specific information. On the other hand, it could be shown that external application of electric field pulses influences the synthesis of messenger molecules. By coupling cells to the surface of semiconductor sensors biohybrid devices are created that are able to convert and to amplify molecular or physical input signals into detectable electrical, metabolic or morphological output signal patterns. This allows the assembly of dynamic and highly sensitive transducers of biochemical or physical signals relevant to cells. If required, such electrical readout devices can be combined with optical visualisation techniques in order to correlate the measured signal output of the cell with additional information about the underlying processes on the subcellular level. Practical applications of this technology are obvious, where the real time analysis of cellular signal processing (for example in pharmaceutical drug testing and biomolecular analytics) is of primary importance. [C735]

"Nanophotonic materials and devices for optical system integration"

Summary form only given. We explore the unique capabilities and advantages of nanotechnology in developing next generation integrated photonic chips. For example, due to the boundary conditions on the lateral interfaces, the optical field propagating in a subwavelength periodic nanostructure will localize in a significantly different way depending on the polarization. Our long-range goal is to develop a range of photonic nanostructures-including artificially birefringent and devices, photonic crystals with defects to tailor spectral filters, and nanostructures for spatial field localization to enhance optical nonlinearities-to facilitate on-chip system integration through compatible materials and fabrication processes. [C736]

"Traps in (nc-Si/CaF2)50 nanostructures"

Traps in multi-quantum well (nc-Si/CaF2)50nanostructures using optical charging spectroscopy method were investigated. Three maxima and a final abrupt increase were found in the discharge current versus temperature characteristics. The relative contributions of the tunneling and displacement currents through the insulating calcium fluoride were analyzed. [C737]

"Photonic crystals and microlasers"

Photonic nanostructure devices based on photonic crystals and high index contrast are now being studied worldwide for various applications. The miniaturization of devices and their high density integration are attractive targets. Some simple devices that provide novel high performance and/or unique characteristics are also expected. This presentation outlines their current status and introduces some results of our study. Devices considered include light emitters (lasers and LEDs), waveguides and transmission-type devices. [C738]

"Quantum tunneling Sb-heterostructure millimeter-wave diodes"

We have developed a new zero bias millimeter wave diode based on quantum tunneling in an InAs/AlSb/GaSb nanostructure. It is ideal for square law radiometry and passive millimeter wave imaging. Excellent sensitivity has

been demonstrated at present up to 110 GHz, with higher bandwidth predicted for smaller area diodes [C739]

"Intensive coherent X-rays from multilayer mirrors"

The results of experiment on further investigations of coherent X-ray emission produced by relativistic electrons passing through the periodic multilayer nanostructures well-known in X-ray optic as X-ray mirrors. Recently, we observed this new effect in the experiment carried out at the Tomsk "Sirius" synchrotron and found that a X-ray mirror might be used as a novel radiator for generation of monochromatic and narrow directed X-rays emitting at the large (Bragg) angle θ0=1.9° with respect to the mirror surface and at the angle θD=3.8° with respect to the electron beam direction. In this work we present the vertical spatial distributions and orientational dependencies of the spectra of this type of radiation. The results were also obtained at the Tomsk synchrotron with 500 MeV electrons and with two mirrors having the uniform and cluster graded periods. Both the spatial distributions and rocking-curves of radiation yield show the peaks having the narrow minima in the centre of the dependencies. The form and parameters of the dependencies allow to discus the mechanism of the novel effect [C740]

"Ta-rich tantalum silicide nano-cluster diffusion barrier in ULSI metallization"

Sputtered Ta-Sixnanostructure film was investigated as a barrier material for Cu metallization. The TaSixfilm was deposited by co-sputtering of Ta and Si targets in Ar gas. The resistivity of the films varies from 238 μΩ-cm to 900 μΩ-cm with Si/Ta ratio from 0.256 to 2.172. XRD, HRTEM, XPS, and AES were employed to understand the crystalline structure, chemical structure, and atomic composition. Furthermore, we use C-V measurement to study the thermal stability of the TaSi film. The MOS capacitors of sputtered Cu or electroplating Cu/Ta-Si (30 nm)/methylsilsesquioxane (MSQ), porous SiO2or SiO2/p-Si structure were annealed at the temperature from 350°C to 500°C for 30 min in nitrogen ambient. The MSQ and porous SiO2films with thickness 200 nm were spin-coated on the Si wafer. The dielectric constant of these films was about 2.6. From the flat band shift and the variation of inversion capacitance, the diffusion performance can be evaluated [C741]

"Quantum control of electrons in semiconductor nanostructures using spatially uniform electric fields"

We have studied quantum control operations on electrons confined in semiconductor nanostructures using time-dependent spatially uniform electric fields. Our general goal was to manipulate the wave function of one or two electrons and thereby control a certain quantum probability of interest. Since our main interest was in performing certain tasks rather than in developing efficient control methods, we searched relevant parts of our parameter space numerically in a systematic manner. Here we summarize the results of three studies whose common denominator is the fact that the control of the wave function is performed using a uniform electric field, or, in other words, through the electric dipole approximation Hamiltonian Hd= -er·E(t). The subjects of these studies are: Coherent control of multisubband wavepackets with terahertz pulses, single-electron turnstile modelled with two interacting electrons, and dynamical localization of two interacting electrons in coupled quantum dots [C742]

"Fast scan cyclic voltammetry simulation for silicon nanoelectrodes"

A program based on four procedures, written in Borland-Pascal was applied for the simulations of fast scan cyclic voltammetry using as working electrode a metal/silicon pyramidal nanostructure array. The model for the electrode process includes diffusion (Fick's law), electrode kinetics (Butler-Volmer equation), and chemical reaction kinetics [C743]

"The optoelectronic properties of silicon nanostructures: the role of the interfaces"

The optoelectronic properties of Si nanostructures are studied ab initio to investigate their dependence on the dimensions, on the symmetry and on the bonding situations at the interfaces. We find that the dimensions are significative for the transition oscillator strengths and that the symmetry of the lattice changes the nature of the gap. The saturating species and/or the presence of dangling bonds play an important role in the formation of interface states that can occupy or leave free the band gap so making worse or improving the optical properties [C744]

"Enhanced second-harmonic generation in periodic nonlinear optical nanostructures"

At present, the range of applications for nonlinear optical devices is limited in practical terms by the relatively small nonlinear optical coefficients available in natural materials. Recent advances in nanofabrication technologies have enabled the construction of a wide range of subwavelength optical nanostructures. Periodic optical nanostructures made of nonlinear optical materials can be used to enhance nonlinear optical phenomena through two mechanisms: transverse localization and phase matching. In this paper we present nanostructure

designs for the enhancement of second-harmonic generation, analyze the transverse localization and phase matching effects in these structures, and predict the enhancement of the second harmonic generation process using a rigorous electromagnetic modeling tool [C745]

"Laser nano-engineering with the assistance of scanning probe microscope and optical resonance in microparticles"

Optical and thermal processes of an STM junction under laser irradiation were summarized. A general model for the near field of a tip, under polarised laser irradiation is presented in the case of imaging and processing by a laser-assisted scanning probe microscope (SPM). The near field of a tip was calculated using the method of moments. Our calculations show that a 3:1 silver SPM tip can achieve an optical field enhancement of Ч525 on a gold substrate surface. With such a large SPM tip, plasma resonance can be neglected, and the optical enhancement in this case is much less than that predicted for small conductive particle models. Field enhancement and intensity profiles strongly depend on the tip-sample geometry, laser properties and the dielectric properties of the tips and samples. The model can be used for rigorous calculations of the near field of a tip in a laser-assisted SPM. The temperature rise was analyzed in the cases of contact and non-contact occurring between the tip apex and the sample surface. Thermal expansion of the tip can be calculated and compared with the tip-sample distance of an STM junction to determine whether contact between the tip and sample surface occurs or not [C746]

"Nanostructure construction in single-walled carbon nanotubes by AFM manipulation"

Summary form only given. We report nanostructure construction of two-crossing SWNTs fabricated by AFM manipulation. SWNTs used for this study were dissolved in water with the liquid surfactant TRITONR . The solution was dispersed on a Si substrate, and dipped into dichloroethane to clean up the surface of the SWNTs. Visualization and manipulation were performed in air using a noncontact AFM [C747]

"Room temperature nanoimprint technology"

Nano-imprint-lithography (NIL) (Chou et al, 1997), in which resist patterns are fabricated by deforming the resist physical shape through embossing with a mold, is a very useful technique to make nanostructure devices and various nanostructure devices such as a quantized magnetic disk (Wu et al, 1998) have been demonstrated by this method. It has excellent features with sub-10 nm feature size over a large area with high throughput and low cost. However, as a conventional NIL process has to heat a resist above the glass transition temperature to deform the resist physical shape with a mold pattern, the heating process causes serious problems for pattern accuracy. To overcome this problem, room-temperature replication into SOG (spin-on-glass) and HSQ (hydrogen silsesquioxane) (Namatsu et al, 1998) has been proposed and experiments have been conducted. In this paper, we describe a room-temperature replication into SOG/HSQ and a pattern transfer to a metal pattern and a substrate by using lift-off and RIE processes [C748]

"Laser processing of materials and devices"

Summary form only given. Laser processing of materials is widely used for fabrication of devices. The talk will describe the emerging applications of laser processing of materials in areas such as nanotechnology (carbon nanotubes and nanopatterning), micro-electro-mechanical-systems (MEMS), laser crystallization of Si for solar cells and displays, surface texturing, advanced lithography and surface modification. Lasers can provide unique material processing solutions. Laser-solid interactions will develop new fields of nanoscience and technology. Well-controlled nanostructures can be synthesized and manipulated by lasers for future nanodevices. Femtosecond lasers are an exciting new technology for materials processing and device fabrication as it is independent of the optical properties of the materials. We will describe some results obtained with the femtosecond laser to fabricate field emission and grating structures. The practical applications of lasers in the manufacturing process of microelectronic, optoelectronic and microsystems devices will be described [C749]

"Structure and resonant characteristics of amorphous carbon pillars grown by FIB-CVD"

Beam induced deposition is a superior technique for nano-fabrication and nano-mechanics that allows many degrees of freedom, so that any shape can be grown at any position with nanometer accuracy. We have already reported the three-dimensional growth of amorphous carbon, having a nanostructure of wineglass, coils, and bellows, using precursor of phenanthrene gas and a focused Ga+ ion beam (FIB) induced chemical vapor deposition (CVD). High-precision Ga-ion beams controlled by highly stabilized ion optics in an FIB system (SM15020, SEIKO Instruments) enabled not only normal growth of carbon nano-pillars on substrate, but also lateral growth. In this paper, we report an evaluation of the Young's modulus of such amorphous carbon pillars by measuring the resonant frequency of pillars Many improvements are needed in our experimental conditions to

clearly define the growth condition. However, the very large Young's modulus and the flexibility of the nano-structure fabrication in FIB-CVD holds great possibility for future applications of these DLC pillars grown by FIB-CVD [C750]

"MIS-nano-structure creation by the ion bombardment of HTSC-surfaces"

A new way of controlled fabrication of "metal/insulator/superconductor" (MIS) structures with nano- and subnanometer thickness of layers and interfaces is suggested. The way is based on the effect of ion-induced self-organizing restructuring of the near surface region of high temperature superconductors (HTSC). The chemical bond breaking of metal atoms with oxygen stimulated by the bombarding ions is the first stage of the effect. Then the metal atoms diffuse to the surface and form a metallic segregate in the form of a film or a cluster ensemble depending on the ion energy and irradiation dose. The irradiated region loses its superconductivity and is transformed into insulator. The thickness of the dielectric layer is determined by the penetration depth of ions which can be regulated by variation of their energy. The processes pointed out and the properties of the created structures have been studied using electron spectroscopy. As compared to the known structures, the discovered ones are characterized by qualitatively thinner layers and interfaces. [C751]

"Electron field emission from silicon nanoprotrusions"

Recently, enhanced field emission of electrons from a variety of nanostructured materials such as carbon nanotubes, and porous Si has been extensively studied for application to displays and other vacuum electronic devices. In this work, we have studied field emission of electrons by using a diode experimental setup without gate electrodes from the most fundamental Si nanostructure, i.e., Si nanoprotrusions with both vertical and lateral sizes of 10 20 nm and the density of 3 5Ч1011cm-2. The protrusions were fabricated by our original self-organized selective oxidation technique, referred to as "nano-LOCOS". Although the Si protrusions were quite small, high emission current was detected at low anode voltages, depending on the microscopic shape controlled by oxidation conditions. This result encourages us to develop "bright" and "highly functional" electron emitting devices using the Si nanosystem. [C752]

"Nanotechnology toward DNA electronics"

Summary form only given. DNA is one of the most promising molecules which may act as the scaffold for molecular nanotechnology and nanoelectronics. DNA has the special double helix structure with pi-electron cores of well-stacking bases for the use of long-distance (e.g. 200 E) and one-dimensional charge transport. The investigations of DNA in terms of the nanostructure, electrical conductivity and electronic states have significant implications for the application of DNA in electronic devices and in DNA-based electrochemical biosensors [C753]

"Single electron memory effect in TiOx nano-structure"

The single electron memory effect in TiOxnanostructure (thickness 3nm, length 150 nm and width 150 nm) based on localized density of state (LDOS) in metallic oxides is observed. The potential of application in the single electron memory is discussed. [C754]

"A Wigner equation for the nanometer and femtosecond transport regime"

We present a quantum-kinetic equation which describes the transport phenomena in nanoelectronic devices. The equation can be regarded as a generalization of the Boltzmann equation, which describes the operation of the conventional microelectronic devices. The presented equation treats the coherent part of the transport imposed by the nanostructure potential on a rigorous quantum level, utilizing the Wigner picture. It is shown that the equation is general enough to account for quantum effects in the dissipative part of the transport imposed by the electron-phonon interaction. Numerical experiments demonstrate the effects of collision broadening, retardation and the intra-collisional field effect. Theoretical analysis of the equation reveals a novel quantum effect which is due to the correlation between the interaction process and the space component of the Wigner path [C755]

"Is uniform electron emission possible at low macroscopic fields ?"

Summary form only given. For existing thin-film electron emitters (except bulk diamond), low-macroscopic-field (LMF) emission occurs primarily because nanostructure in the film generates local field enhancement (by a factor g) at the vacuum interface, allowing electron tunnelling. Electrostatic considerations then mean significant emission occurs from at most a fraction (about 1/g*g) of the surface. The original hope with carbon thin-film emitters was that LMF emission would occur uniformly over a broad area. This paper looks again at the underlying physics, including space-charge considerations. It defines conditions under which uniform LMF

emission might occur at room temperature and relatively low applied voltage [C756]

"Models for low-macroscopic-field electron emission"

Summary form only given. Low-macroscopic-field (LMF) electron emission occurs primarily because electrical nanostructure in a thin dielectric film generates local field enhancement at its surface, and facilitates electrons tunnelling. A classification of alternative structures that allow LMF emission is made using "Conductor/Dielectric/Vacuum (CDV)" terminology. Emission current may be controlled by one of several system components; hence different control regimes may exist. Some possible transitions are classified. An outline microscopic theory is presented for the transition from front-surface-barrier control to dielectric-conduction-channel control, for a C-D-V system [C757]

"Calculation of quantum well effect for field electron emission of nanostructured carbon"

Carbon nanostructures of different composition and structure including nanocrystalline diamond films, flake-like sp2-bonded CVD carbon films, bulk diamond/sp2-bonded carbon nanocomposites, DLC films, nanotubes, etc., often show excellent field electron emission properties with very low threshold fields of 0.5-2 V/μm and uniformity of emission properties over a large surface area. Based on the special study of microscopic properties of the field emission centers, including work function, electrical conductivity, topography and emission intensity, a mechanism of the emission for such objects is proposed, taking into account quantum properties of nanostructured carbon forms, including reduction of the tunneling barrier due to quantum well effects for thin carbon nanolayers and insulator/graphite interfaces (Karabutov et al, J. Vac. Sci. Tech. B vol. 19, p. 965, 2001). Here, this model is developed, involving detailed calculation of the field emission current from quantum wells and carbon nanostructures [C758]

"Microelectronics roadmap: from ultimate CMOS to quantum information systems"

Summary form only given. The ITRS roadmap shows that scaling efforts will continue to a few tens of nanometers. This paper discusses the ITRS roadmap, leading to the ultimate CMOS and extrapolating to nanoelectronics. The major challenges are the fundamental limit of CMOS scaling and the increased number of global interconnects. Along the path to ultimate CMOS, vertical MOSFET and related devices are discussed. As we approach the nanometer scale, quantum behaviour plays an important role. The question is how to continue Moore's law in increasing functional throughput per unit cost. The paper gives examples for potential off-the-roadmap types of disruptive technologies as a base for discussion. Among these are quantum tunneling devices to increase functional throughput per device. We may also look at alternate architectures such as cellular automata, in which only nearest neighbor interconnects are needed and this type of architecture is most suitable for self-assembly of nanostructures. The self-assembly technique has potential for low cost nanostructure fabrication. Controlled placement of self-organized structures is discussed. In this scheme, semiconductor quantum dots were grown on Si. The dot size, shape and density can be controlled by growth temperature, deposited coverage and doping. Cooperative, well-organized Ge quantum dots were achieved and they offered potential applications of dot arrays for potential cellular systems. Eventually, entirely new massive parallel quantum computation systems may evolve. A possible semiconductor implementation based on SiGe nanostructures is discussed [C759]

"Recent progress in the study of the property and effect of the interface and surface of field electron emission nanostructures using amorphous diamond film"

Details are given of a systematic experimental study into the effect of interface structure on the field emission properties of nano-structures using amorphous diamond. Surface features considered to be responsible for low field emission are discovered. Based on this latter finding, a new mechanism responsible for electron emission from a-D film is presented [C760]

"Nonlithographic semiconductor nanoscale devices"

Summary form only given. We have developed a thin film template based nanostructure synthesis technique that is applicable for the development of high performance electronic and photonic devices on silicon, glass and other planar substrates. The technique is based on the anodization of a thin film of aluminum to form an alumina template;. synthesizing the active material inside these nanoscale pores then forms the nanostructures. We are currently using the above template-based technology for the fabrication of a variety of devices including (i) nanostructure-based solar cells, (ii) narrowband optical detectors, (iii) electro-optic modulators and (iv) Coulomb-blockade devices [C761]

"InAs nanostructure devices fabricated by AFM oxidation process"

We describe atomic force microscope (AFM) oxidation processes developed for nanofabrication of InAs/(Al)GaSb heterostructures. The fabrication process is based on anodization that occurs between the AFM tip and the semiconductor surfaces. We systematically studied the oxidation characteristics and nanofabrication capabilities for each constituent material in order to develop a simple fabrication processes utilizing AFM oxidation. Device characteristics verifying the nanofabrication capability for each AFM oxidation process are described [C762]

"Nanostructure based electro-optic modulators for high speed optical interconnects"

We are currently developing a CMOS compatible optical modulator based on semiconductor nanostructure arrays that has the potential to provide large modulation depths as well as very high operation speeds. The basis of the expected performance improvements are the strong non-linear and electro-optic effects that occur in low dimensional nanostructures due to quantum confined Franz-Keldysh effect and quantum confined Stark effect. The nanostructures are fabricated by a novel thin film template-based synthesis technique that is CMOS compatible. The technique is based on the anodization, or electrolytic oxidation, of a thin film of aluminum to form a nanoporous alumina template, which guides the synthesis of the semiconductor nanostructures. [C763]

"Layered nanoassembly of three-dimensional structures"

NEMS (nanoelectromechanical systems) loom beyond the MEMS horizon as the new frontier in miniaturization. Nanorobots and other NEMS are expected to find revolutionary applications in science, engineering and everyday life. Until now, nanostructures have been built primarily in 2D, because of the difficulties of 3D fabrication. This paper describes a promising approach to the construction of 3D nanostructures by working in successive layers, much like the rapid prototyping techniques used in the macroscopic world. Each object nanolayer is built by nanomanipulation, or possibly by programmed self-assembly, and then surrounded by a sacrificial layer that planarizes the sample and serves as a substrate for the deposition of the next object nanolayer. Initial experimental results which show that the approach is feasible are presented. [C764]

"Thermal conductivity in semiconductor thin films and nanowires"

Summary form only given. In this talk we present a self-consistent model for calculating the lattice thermal conductivity in semiconductor thin films and nanowires. The model is based on the solution of the phonon Boltzmann equation. It rigorously takes into account modification of the acoustic phonon dispersion in low-dimensional structures with the lateral feature size of 10 nm-30 nm, and change in the non-equilibrium phonon distribution due to partially diffuse scattering from rough boundaries and interfaces. It is shown that the presence, of distinctive boundaries in such structures leads to a transformation of the acoustic branches of phonon dispersion to quasi-optical branches characterized by a low group velocity and different cut-off frequencies. This transformation affects both in-plane and cross-plane thermal conduction in low-dimensional structures. In this talk we also analyze three-phonon Umklapp scattering processes in thin films and nanowires and compare them with those in bulk semiconductors. The predictions. of the thermal conductivity. values based on our model are in good agreement with available experimental data for silicon thin films and nanowires. The described changes in phonon transport in semiconductor thin films and nanowires bear important consequences for nanostructure and device simulation since neither Fourier beat theory nor Debye approximation are accurate at nanometer length scale. The observed modification of the thermal resistance of the low-dimensional structures has to be taken into account in simulation of thermal transport in deep-submicron devices since, it strongly affects the electrostatic, discharge voltage (EDS) and other reliability characteristics. The change in the acoustic phonon dispersion and group velocity may be partially responsible for the experimentally observed drop of EDS in devices based on thin-film silicon-on-insulator (SOI) wafers [C765]

"Device Research Conference. Conference Digest (Cat. No.01TH8561)"

The following topics are dealt with: silicon devices; III-V devices and sources; detectors; nanostructure modeling; TFTs; wide band gap semiconductors [C766]

"Substrate surface effect on the fabrication of nanomagnets using spin-coating technique"

A simple method of depositing wide array of monolayers of 1 μm micron sized polystyrene latex particles using spin coating is presented. By comparing the results obtained on silicon (100) substrates and thermal oxide covered silicon, it was noticed that the oxide led to a marked increase in the area of monolayer array. Magnetic nanostructures were formed by deposition of a nickel layer followed by subsequent lift-off. Magnetic force microscopy results were discussed [C767]

"Magnetization reversal in ion beam nanostructured Co/Pt multilayers"

The perpendicular magnetization reversal in thin multilayer films is investigated experimentally by magnetooptical Kerr rotation and by light diffraction at nanostructures. Considering the dependence of the reversal velocity on the applied field, a prediction of the magnetic behaviour is possible using a minimum energy model, including mechanical stress and temperature behaviour [C768]

"Customizable nanotweezers for manipulation of free-standing nanostructures"

We present a novel nanotweezer device for manipulation and measurement of free-standing nanostructures, where the shape of the tweezer tips can be customized for the application. Electrostatic actuators with submicron interelectrode spacings are fabricated on a batch level using silicon microfabrication techniques. The actuators are capable of opening and closing with respect to the neutral position, and the full range of actuation exceeds 330 nm. The nanotweezer tips are fabricated using electron beam induced deposition; an electron beam of a scanning electron microscope is focused at the ends of the cantilevers, leading to the formation of 40-100 nm diameter carbon-based tips. Careful alignment of the substrate and the beam, as well as proper selection of growth mode, results in converging tips forming nanogaps down to 20 nm. The nanotweezers can be metallized to be used for electrical measurements of nanostructures [C769]

"Optimization of KOH wet etching process in silicon nanofabrication"

The simple wet etching process for nanostructure formation seems straightforward. But, how far the wet etching process can be pushed so that it is applicable in silicon nanodevices and silicon nanostructure applications. In terms of surface roughness and achievable feature size, the impact of aqueous KOH wet etching temperature was studied for nanostructure formation with (110) silicon wafer. The grid-line patterns are generated by scanning probe lithography (SPL), which applied a bias between the tip and the (110)-oriented silicon wafer that results in an oxide hard mask for subsequent orientation-dependent etching (ODE) process. The etching rate is theoretically proportional to temperature the higher the temperature the higher the etching rate, whilst the surface roughness and the nanostructures morphology deteriorated. Owing to the etching selectivity of (111)-plane/oxide decreases as the etching temperature increases, it is found that the line-width of 20 nm nanostructure can be formed at 50°C but with poor surface roughness morphology. For the same etching depth, when the temperature changes from 50°C to 30°C the linewidth of nanostructure increases from 29 nm up to 67 nm, but surface roughness decreases from 32 nm to 3.8 nm. It is also found that the additional agitation by ultrasonic cleaner can speed up mass transfer of chemical reactants on surface of (110)-plane such that the surface roughness and morphology are further improved. We have demonstrated that: First, the optimization linewidth of the silicon nanofabrication can be reduced down to 20 nm by using higher aqueous temperature than 30°C and ODE technique with ultrasonic agitation. Second, the surface roughness of the wet etching with ultrasonic agitation is 3.282 nm which is comparable to that of dry etching (Rq = 2.101 nm) at the temperature 30°C [C770]

"Characteristics of dendrimer functionalized with azobenzene for the application to nano-level photo-switching device"

If we can make characterization of nano-structure with functionality, the molecular level device will be obtained. The dendrimer has been well known as a promising macromolecules for a building the organized nanostructure, which of the size can be controlled and which of periphery can be terminated by various functionalities. In this study, we synthesized dendrimers containing light switchable units, azobenzene group. Their chemical structure was verified by using NMR study and UV spectroscopy. To apply to the molecular level switching device or data storage system using Langmuir-Blodgett(LB) film, we firstly investigated the monolayer behavior using pi-A isotherm at air/water interface. And then the surface pressure shift of monolayer by light irradiation was also measured. As a result, the monolayer of dendrimer with azobenzene group showed the reversible photo-switching behavior by the isomerization of azobenzene group in their periphery. This result strongly suggests that a dendrimer with azobenzene group can be applied to high efficient photo-switching device of molecular level [C771]

"Nanostructures of zero magnetization in orthoferrites"

In orthoferrites-canted ferromagnets with extremely high domain wall velocities-the change of handedness in the domain walls does not occur in Bloch lines but in lines of zero magnetization, which represent magnetooptical nanostructures. Observations of the lines and of the domain wall inclinations in plates of yttrium orthoferrite are reported. The inclinations take place in the direction of the crystallographic α axis and reach tens of degrees [C772]

"Fabrication of nanostructures with interferometric lithography"

Summary form only given. Nanostructures, features with characteristic dimensions between 1- and 100-nm, are the focus of much current attention as a result of the unique physical properties offered in this mesoscopic regime. As semiconductor-processing technology has matured, the ability to create small structures has improved. Traditional nanostructure fabrication involves serial processing, e.g. e-beam lithography. For many applications, such as heterostructure crystal growth, a large-area parallel processing capability is vital. One optical lithography technique, interferometric lithography (IL), is a powerful technique for making nanostructures, providing an inexpensive method to generate nano-scale features over large areas [C773]

"Near-infrared transmission and emission characteristics of frequency selective surfaces and its nano-fabrication issues"

Summary form only given. Frequency selective surfaces consist of conducting patch or aperture periodic arrays. They have been recognized for some time, as spectrally selective filters at microwave, millimeter and infrared wavelengths. Several manufacturing techniques are being considered to meet the demand for fast, reliable and cost-effective nano-lithography. One possible solution to nanostructure manufacturing is nanoimprint lithography. This technique is based on the physical deformation of the resist cast on a substrate by a mask with submicron structures on its surface. It offers a cost-effective alternative to DEBL. We will present a comparative study of FSSs fabrication by electron-beam and nanoimprint lithographies We provide a comparison between theory and experiment on the spectral properties of several FSSs in the 2-15 μm range, examining several factors that influence the resonant drop in transmission of the FSSs: shape, size, spacing and sheet resistance of the elements and dielectric properties of the surroundings [C774]

"Carbon nanostructure growth in an inductively coupled plasma"

Summary form only given, as follows. Carbon nanostructures have been grown in a modified GEC Reference Cell. The inductively coupled plasma is generated with 500 watts of 13.56 RF power applied to a five turn coil. A second 500 watt RF power supply is used to bias the substrate. The carbon nanostructures were grown on silicon substrates covered with 100E-200 E Fe thin films, which serve as a catalyst. Argon at 100 mT is used as a buffer gas to sustain the inductively coupled mode. Varying ratios of CH4and H2are added to the gas as needed by the growth mechanisms. Several morphologies were obtained. Raman spectroscopy, scanning electron microscopy (SEM), transmission electron microscopy (TEM) and high resolution TEM are used to examine the samples. Growth morphologies as a function of plasma and reactor parameters are discussed [C775]

"Fabrication of magnetic nanostructures using the focused ion beam technique"

A potential approach to extend the current areal density of magnetic recording beyond 300 Gb/in2is physical patterning of the media. Among all the techniques that have been employed to-pattern the continuous media into nanometer scale discrete tracks and bits, the focused ion beam (FIB) nanofabrication is one of the most straightforward techniques that does not require the use of various types of masks and molds. There has been much interest in nano-patterning of hard and soft magnetic materials and perpendicular recording media using the FIB, but very few of them has been focused on the milling processes. In this work, the FIB patterning of commercial post-sputtering longitudinal media is demonstrated. Special efforts have been put on optimizing the milling process through controlling the magnification, milling depth, and the ion beam scan mode. It was found that the parallel milling mode was effective in reducing the re-deposition at small depth and thus led to smaller nano-structures. The FIB processed nanostructures have been characterized using AFM and MFM. Patterns with square islands of 50 nm and spacing of 10 nm have been obtained. It is interesting to note that, in both serial and parallel milling modes at large depth, the re-deposition has accumulated at the junctions of the original dots and formed new dots. As dots formed by re-deposition have already lost their magnetic properties, they should be suppressed as much as possible. In the contrast to this, the re-deposition was almost eliminated in the parallel-milling mode at small depth. It can be seen clearly from the MFM observation that the in-plane magnetization has been pertained for the patterned structures at dimensions as small as 50 nm and single domain structures were observed. The structures obtained in this work can be used to study magnetic recording at contact mode and at very high recording density [C776]

"Temperature-dependent near-field imaging of delocalized and localized excitons in single quantum wires"

Summary form only given. Recent microphotoluminescence studies have shown that the low-temperature emission spectra of semiconductor quantum wires are dominated by localized, quasi-zero-dimensional, excitons.

This implies that both the optical and transport properties of such quasi-one-dimensional (Q1D) nanostructures are similar to that of a chain of quantum dots. It also hinders the observation of some truly one-dimensional quantum effects, such as the ballistic or diffusive one-dimensional exciton transport, expected in nanostructures containing Q1D excitons that are delocalized over mesoscopic length scales. We present the first experimental evidence for such delocalized excitons in a single quantum wire. A novel coupled quantum wire-dot nanostructure is studied by low temperature near-field photoluminescence (PL) spectroscopy. [C777]

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