Device Applications Of Silicon Nanocrystals And Nanostructures Nanostructure Science And Technology

This book focuses on nanostructured semiconductors, their fabrication, and their application in various fields such as optics, acoustics, and biomedicine. It presents a compendium of recent developments in nanostructured and hybrid materials and also contains a collection of principles and approaches related to nano-size semiconductors. The text summarizes the recent work by renowned scientists, emphasizing the synthesis by self-assembly or prestructuring and characterization methods of such nanosize materials and also discusses the potential applications of nanostructured semiconductors and hybrid systems. The book also gives adequate coverage to the novel properties of nanostructured and low-dimensional materials.

Energetic ion beam irradiation is the basis of a wide plethora of powerful research- and fabrication-techniques for materials characterisation and processing on a nanometre scale. Materials with tailored optical, magnetic and electrical properties can be fabricated by synthesis of nanocrystals by ion implantation, focused ion beams can be used to machine away and deposit material on a scale of nanometres and the scattering of energetic ions is a unique and quantitative tool for process development in high speed electronics and 3-D nanostructures with extreme aspect radios for tissue engineering and nano-fluidics lab-on-a-chip may be machined using proton beams. This book will benefit practitioners, researchers and graduate students working in the field of ion beams and application and more generally everyone concerned with the broad field of nanoscience and technology.

Nanocrystals research has been an area of significant interest lately, due to the wide variety of potential applications in semiconductor, optical and biomedical fields. This book consists of a collection of research work on nanocrystals processing and characterization of their structural, optical, electronic, magnetic and mechanical properties. Various methods for nanocrystals synthesis are discussed in the book. Size-dependent properties such as quantum confinement, superparamagnetism have been observed in semiconductor and magnetic nanoparticles. Nanocrystals incorporated into different material systems have proven to possess improved properties. A review of the exciting outcomes nanoparticles study has provided indicates further accomplishments in the near future.

The book “Quantum dots: A variety of a new applications” provides some collections of practical applications of quantum dots. This book is divided into four sections. In section 1 a review of the thermo-optical characterization of CdSe/ZnS core-shell nanocrystal solutions was performed. The Thermal Lens (TL) technique was used, and the thermal self-phase Modulation (TSPM) technique was adopted as the simplest alternative method. Section 2 includes five chapters where novel optical and lasing application are discussed. In section 3 four examples of quantum dot system for different applications in electronics are given. Section 4 provides three examples of using quantum dot system for biological applications. This is a collaborative book sharing and providing fundamental research such as the one conducted in Physics, Chemistry, Biology, Material Science, Medicine with a base text that could serve as a reference in research by presenting up-to-date research work on the field of quantum dot systems.

In this study, silicon nanocrystals (NC) were synthesized in silicon dioxide matrix by ion implantation followed by high temperature annealing. Annealing temperature and duration were varied to study their effect on the nanocrystal formation and optical properties. Implantation of silicon ions was performed with different energy and dose depending on the

oxide thickness on the silicon substrate. Before device fabrication, photoluminescence (PL) measurement was performed for each sample. From PL measurement it was observed that, PL emission depends on nanocrystal size determined by the parameters of implantation and annealing process. The peak position of PL emission was found to shifts toward higher wavelength when the dose of implanted Si increased. Two PL emission bands were observed in most cases. PL emission around 800 nm originated from Si NC in oxide matrix. Other emissions can be attributed to the luminescent defects in oxide or oxide/NC interface. In order to see electroluminescence properties Light Emitting Devices (LED) were fabricated by using metal oxide semiconductor structure, current-voltage (I-V) and electroluminescence (EL) measurements were conducted. I-V results revealed that, current passing through device depends on both implanted Si dose and annealing parameters. Current increases with increasing dose as one might expect due to the increased amount of defects in the matrix. The current however decreases with increasing annealing temperature and duration, which imply that, NC in oxide behave like a well controlled trap level for charge transport. From EL measurements, few differences were observed between EL and PL results. These differences can be attributed to the different excitation and emission mechanisms in PL and EL process. Upon comparision, EL emission was found to be inefficient due to the asymmetric charge injection from substrate and top contact. Peak position of EL emission was blue shifted with respect to PL one, and approached tow.

Semiconductor nanocrystals and metal nanoparticles are the building blocks of the next generation of electronic, optoelectronic, and photonic devices. Covering this rapidly developing and interdisciplinary field, the book examines in detail the physical properties and device applications of semiconductor nanocrystals and metal nanoparticles. It begins with a review of the synthesis and characterization of various semiconductor nanocrystals and metal nanoparticles and goes on to discuss in detail their optical, light emission, and electrical properties. It then illustrates some exciting applications of nanoelectronic devices (memristors and single-electron devices) and optoelectronic devices (UV detectors, quantum dot lasers, and solar cells), as well as other applications (gas sensors and metallic nanopastes for power electronics packaging). Focuses on a new class of materials that exhibit fascinating physical properties and have many exciting device applications. Presents an overview of synthesis strategies and characterization techniques for various semiconductor nanocrystal and metal nanoparticles. Examines in detail the optical/optoelectronic properties, light emission properties, and electrical properties of semiconductor nanocrystals and metal nanoparticles. Reviews applications in nanoelectronic devices, optoelectronic devices, and photonic devices.

This comprehensive, up-to-date book systematically covers recent developments in the technology of silicon nanocrystals and silicon nanostructures, where quantum-size effects are important. The chapters include a number of examples of device applications.

Nanoscale materials are showing great promise in various electronic, optoelectronic, and energy applications. Silicon (Si) has especially captured great attention as the leading material for microelectronic and nanoscale device applications. Recently, various silicides have garnered special attention for their pivotal role in Si device engineering and for the vast potential they possess in fields such as thermoelectricity and magnetism. The fundamental understanding of Si and silicide material processes at nanoscale plays a key role in achieving device structures and performance that meet real-world requirements and, therefore, demands investigation and exploration of nanoscale device applications. This book comprises the theoretical and experimental analysis of various properties of silicon nanocrystals, research methods and techniques to prepare them, and some of their promising applications.

The development of integrated silicon photonic circuits has recently been driven by the Internet and the push for high bandwidth as well as the need to reduce

power dissipation induced by high data-rate signal transmission. To reach these goals, efficient passive and active silicon photonic devices, including waveguide, modulators, photodetectors, multiplexers, light sources, and various subsystems, have been developed that take advantage of state-of-the-art silicon technology. Suitable for both specialists and newcomers, Handbook of Silicon Photonics presents a coherent and comprehensive overview of this field from the fundamentals to integrated systems and applications. It covers a broad spectrum of materials and applications, emphasizing passive and active photonic devices, fabrication, integration, and the convergence with CMOS technology. The book's self-contained chapters are written by international experts from academia and various photonics-related industries. The handbook starts with the basics of silicon as an optical material. It then describes the building blocks needed to drive integrated silicon photonic circuits and explains how these building blocks are incorporated in complex photonic/electronic circuits. The book also presents applications of silicon photonics in numerous fields, including biophotonics and photovoltaics. With many illustrations, including some in color, this handbook provides an up-to-date reference to the broad and rapidly changing area of silicon photonics. It shows how basic science and innovative technological applications are pushing the field forward.

This book presents the state of the art of computational intelligence ion engineering. It offers challenging problems for efficient modeling of intelligent systems and details different methodologies of computational intelligence with real life applications.

As part of its current physics decadal survey, Physics 2010, the NRC was asked by the DOE, NSF, and NASA to carry out an assessment of and outlook for the broad field of plasma science and engineering over the next several years. The study was to focus on progress in plasma research, identify the most compelling new scientific opportunities, evaluate prospects for broader application of plasmas, and offer guidance to realize these opportunities. The study paid particular attention to these last two points. This "demand-side" perspective provided a clear look at what plasma research can do to help achieve national goals of fusion energy, economic competitiveness, and nuclear weapons stockpile stewardship. The report provides an examination of the broad themes that frame plasma research: low-temperature plasma science and engineering; plasma physics at high energy density; plasma science of magnetic fusion; space and astrophysical science; and basic plasma science. Within those themes, the report offers a bold vision for future developments in plasma science.

The open access journal Micromachines invites manuscript submissions for the Special Issue “Silicon Photonics Bloom”. The past two decades have witnessed a tremendous growth of silicon photonics. Lab-scale research on simple passive component designs is now being expanded by on-chip hybrid systems architectures. With the recent injection of government and private funding, we are living the 1980s of the electronic industry, when the first merchant foundries were

established. Soon, we will see more and more merchant foundries proposing well-established electronic design tools, product development kits, and mature component libraries. The open access journal Micromachines invites the submission of manuscripts in the developing area of silicon photonics. The goal of this Special Issue is to highlight the recent developments in this cutting-edge technology.]

This unique collection of knowledge represents a comprehensive treatment of the fundamental and practical consequences of size reduction in silicon crystals. This clearly structured reference introduces readers to the optical, electrical and thermal properties of silicon nanocrystals that arise from their greatly reduced dimensions. It covers their synthesis and characterization from both chemical and physical viewpoints, including ion implantation, colloidal synthesis and vapor deposition methods. A major part of the text is devoted to applications in microelectronics as well as photonics and nanobiotechnology, making this of great interest to the high-tech industry.

In addition, UHV nc-AFM guarantees high detection sensitivity and stability in charge imaging experiments, so a 3D electrostatic model based on method of images algorithm can be developed to provide quantitative information regarding the charge distribution and evolution. The algorithm was also applied in the 3D simulation of Si nanocrystal memory.

Nanoscale materials are showing great promise in various optoelectronics applications, especially the fast-developing fields of optical communication and optical computers. With silicon as the leading material for microelectronics, the integration of optical functions into silicon technology is a very important challenge. This book concentrates on the optoelectronic properties of silicon nanocrystals, associated phenomena and related topics, from basic principles to the most recent discoveries. The areas of focus include silicon-based light-emitting devices, light modulators, optical wavevguides and interconnectors, optical amplifiers and memory elements. The book comprises theoretical and experimental analyses of various properties of silicon nanocrystals, research methods and preparation techniques, and some promising applications.

In the 50 years since the first volume of Progress in Optics was published, optics has become one of the most dynamic fields of science. The volumes in this series that have appeared up to now contain more than 300 review articles by distinguished research workers, which have become permanent records for many important developments, helping optical scientists and optical engineers stay abreast of their fields. Comprehensive, in-depth reviews Edited by the leading authority in the field

Presents recent developments in theoretical and experimental research of nanophotonics Discusses properties and features of nanophotonic devices, e.g. scanning near-field optical microscopy, nanofi ber/nanowire based photonic devices Illustrates the most promising nanophotonic devices and instruments and their application Suits well for researchers and graduates in nanophotonics field Contents

Scanning near-field optical microscopy Nanofibers/nanowires and their applications in photonic components and devices Micro/nano-optoelectronic devices based on photonic crystal

Volume is indexed by Thomson Reuters CPCI-S (WoS). Silicon ultra-large scale integrated circuits (ULSIs) are now faced with various physical limits to further scaling. Therefore, it is very important to establish the fundamental science and technology required to produce nano-scale complementary metal-oxide-semiconductor devices (Nano-CMOS) having high performance, new functionalities and larger-scale integration. The scope of this book covers: - Nano-scale complementary metal-oxide-semiconductor devices (Nano-CMOS), - Novel functional devices, materials, and nanoprocessing technologies, - Nano-bio physics and technologies for future nano devices, - Variability control technologies and Signal integrity. This makes it a very useful handbook on the subject.

Nanosilicon: Properties, Synthesis, Applications, Methods of Analysis and Control examines the latest developments on the physics and chemistry of nanosilicon. The book focuses on methods for producing nanosilicon, its electronic and optical properties, research methods to characterize its spectral and structural properties, and its possible applic

This book presents invited reviews and original short notes of recent results obtained in studies concerning the fabrication and application of nanostructures, which hold great promise for the new generation of electronic and optoelectronic devices. Governing exciting and relatively new topics such as fast-progressing nanoelectronics and optoelectronics, molecular electronics and spintronics, nanophotonics, nanosensorics and nanobiology as well as nanotechnology and quantum processing of information, this book gives readers a more complete understanding of the practical uses of nanotechnology and nanostructures.

Since its inception in 1966, the series of numbered volumes known as Semiconductors and Semimetals has distinguished itself through the careful selection of well-known authors, editors, and contributors. The Willardson and Beer series, as it is widely known, has succeeded in producing numerous landmark volumes and chapters. Not only did many of these volumes make an impact at the time of their publication, but they continue to be well-cited years after their original release. Recently, Professor Eicke R. Weber of the University of California at Berkeley joined as a co-editor of the series. Professor Weber, a well-known expert in the field of semiconductor materials, will further contribute to continuing the series' tradition of publishing timely, highly relevant, and long-impacting volumes. Some of the recent volumes, such as Hydrogen in Semiconductors, Imperfections in III/V Materials, Epitaxial Microstructures, High-Speed Heterostructure Devices, Oxygen in Silicon, and others promise that this tradition will be maintained and even expanded. Reflecting the truly interdisciplinary nature of the field that the series covers, the volumes in Semiconductors and Semimetals have been and will continue to be of great interest to physicists, chemists, materials scientists, and device engineers in modern industry.

Filling the need for a single work specifically addressing how to use plasma for the fabrication of nanoscale structures, this book is the first to cover plasma deposition in sufficient depth. The author has worked with numerous R&D institutions around the world, and here he begins with an introductory overview of plasma processing at micro-

and nanoscales, as well as the current problems and challenges, before going on to address surface preparation, generation and diagnostics, transport and the manipulation of nano units.

The field of Si-based optoelectronics is greatly expanding and attracting increased interest from the scientific community. This interest is largely motivated by the possibility of combining, on the same substrate, the excellent data-processing performances of Si-based electronic functions with the unrivaled capability of light in the transmission of information. In fact, experimental efforts have led to several breakthroughs that promise new approaches and potential commercialization of low-cost Si-based photonic devices. Physical properties and optical performance of various materials (nanocrystals, porous Si, Er-doped Si and SiGe, to mention just a few examples) are now reasonably well understood, and the requirements necessary for efficient device performances have been elucidated. Experimental and theoretical contributions are presented here and topics include: Si-based integrated optoelectronics - state of the art and perspectives; waveguides and modulators; integrated and discrete light sources and detectors; properties and applications of silicon nanocrystals; materials for IR and visible light emission; and new materials and device concepts.

Device Applications of Silicon Nanocrystals and NanostructuresSpringer

Recent developments in the technology of silicon nanocrystals and silicon nanostructures, where quantum-size effects are important, are systematically described including examples of device applications. Due to the strong quantum confinement effect, the material properties are freed from the usual indirect- or direct-bandgap regime, and the optical, electrical, thermal, and chemical properties of these nanocrystalline and nanostructured semiconductors are drastically changed from those of bulk silicon. In addition to efficient visible luminescence, various other useful material functions are induced in nanocrystalline silicon and periodic silicon nanostructures. Some novel devices and applications, in fields such as photonics (electroluminescence diode, microcavity, and waveguide), electronics (single-electron device, spin transistor, nonvolatile memory, and ballistic electron emitter), acoustics, and biology, have been developed by the use of these quantum-induced functions in ways different from the conventional scaling principle for ULSI.

This book presents invited reviews and original short notes of recent results obtained in studies concerning the fabrication and application of nanostructures, which hold great promise for the new generation of electronic and optoelectronic devices.Governing exciting and relatively new topics such as fast-progressing nanoelectronics and optoelectronics, molecular electronics and spintronics, nanophotonics, nanosensorics and nanobiology as well as nanotechnology and quantum processing of information, this book gives readers a more complete understanding of the practical uses of nanotechnology and nanostructures.

The 2008 Spring Meeting of the Arbeitskreis Festkörperphysik was held in Berlin, Germany, between February 24 and February 29, 2008 in conjunction with the 72nd Annual Meeting of the Deutsche Physikalische Gesellschaft. The 2008 meeting was the largest physics meeting in Europe and among the largest physics meetings in the world in 2008.

The papers included in this issue of ECS Transactions were originally presented in the symposium ¿Nanocrystal Embedded Dielectric for Electronic and Photonic Devices¿, held during the 215th meeting of The Electrochemical Society, in San Francisco, California from May 24 to 29, 2009.

The book gives an in-depth description of key devices of current and next generation fibre optic communication networks. Devices treated include semiconductor lasers, optical amplifiers,

modulators, wavelength filters and other passives, detectors, all-optical switches, but relevant properties of optical fibres and network aspects are included as well. The presentations include the physical principles underlying the various devices, technologies used for their realization, typical performance characteristics and limitations, but development trends towards more advanced components are also illustrated. This new edition of a successful book was expanded and updated extensively. The new edition covers among others lasers for optical communication, optical switches, hybrid integration, monolithic integration and silicon photonics. The main focus is on Indium phosphide-based structures but silicon photonics is included as well. The book covers relevant principles, state-of-the-art implementations, status of current research as well as expected future components.

This book deals with the concepts of structural integrity from safe life to damage tolerance to holistic structural integrity processes, which are all part of a reliability-centered closed loop design approach. Volume 1 introduces the concepts of structural integrity and the basics of fatigue design, including the development of safe life fatigue design concepts based on traditional continuum mechanics. An extensive discussion of discontinuities is presented to illustrate their importance to all deformation mechanisms and especially the mechanisms of fatigue. The historical aspects of fatigue design are also introduced with emphasis on the stress-life and strain-life approaches, along with the many factors that affect fatigue life of structures and their utilization in society. Latter chapters of the book briefly discuss the extraneous effects on fatigue such as corrosion, fretting, wear, creep, and accidental damage. These will be dealt with in more detail in latter volumes. Finally, the book gives many examples of fatigue failures that have occurred in history and cites ways these could have been prevented and the lessons learned from such fatigue failures.

Authored by leading experts from around the world, the three-volume Handbook of Nanostructured Thin Films and Coatings gives scientific researchers and product engineers a resource as dynamic and flexible as the field itself. The first two volumes cover the latest research and application of the mechanical and functional properties of thin films and coatings, while the third volume explores the cutting-edge organic nanostructured devices used to produce clean energy. This second volume, Nanostructured Thin Films and Coatings: Functional Properties, focuses on functional properties (i.e., optical, electronic, and electrical) and related devices and applications. It also addresses topics such as: Large-scale fabrication of functional thin films using nanoarchitecture via chemical routes Fabrication and characterization of SiC nanostructured/nanocomposite films Low-dimensional nanocomposite fabrication and its applications Optical and optoelectronic properties of silicon nanocrystals embedded in SiO2 matrix Electrical properties of silicon nanocrystals embedded in amorphous SiO2 matrix Optical aspects of properties and applications of sol-gel-derived nanostructured thin films Controllably micro/nanostructured films and devices Thin-film shape memory alloy for microsystem applications A complete resource, this handbook provides the detailed explanations that newcomers need, as well as the latest cutting-edge research and data for experts. Covering a wide range of mechanical and functional technologies, including those used in clean energy, these books also feature figures, tables, and images that will aid research and help professionals acquire and maintain a solid grasp of this burgeoning field. The Handbook of Nanostructured Thin Films and Coatings is composed of this volume and two others: Nanostructured Thin Films and Coatings: Mechanical Properties Organic Nanostructured Thin Film Devices and Coatings for Clean Energy

Silicon nanocrystals or quantum dots combine the abundance and nontoxicity of silicon with size-tunable energy band structure of quantum dots to form a new type of functional material that has applications in biomedical fluorescence imaging, photodynamic therapy, light-emitting devices, and solar cells. The surface is the major concern for using silicon nanocrystals in bio-related applications. Room temperature hydrosilylation is introduced to functionalize silicon

nanocrystals in the dark to minimize temperature/photon-induced side reactions that can potentially damage the nanocrystal surface and capping ligands. As a proof of concept, silicon nanocrystals are passivated with styrene at room temperature, without showing styrene polymerization. Silicon nanocrystals are also conjugated to iron oxide nanocrystals through room temperature hydrosilylation to generate fluorescent/magnetic cell labeling probes. Thermally-induced thiolation is used to generate silicon nanocrystals passivated with silicon-sulfur bond that is metastable and can turn to silicon-carbon bond through a ligand exchange. The band gap and emission color of silicon nanocrystals depend on size. Monodisperse silicon nanocrystals and their self-assembly are of great importance for the applications in light-emitting devices and solar cells. Silicon nanocrystals are size-selected through a modified size-selective precipitation. Face-centered cubic superlattices are formed with monodisperse silicon nanocrystals, and characterized by using grazing incidence small angle X-ray scattering. The structure of silicon nanocrystal superlattice is stable at temperatures up to 375oC, due to the covalent Si-C bond on the nanocrystal surface. Silicon and gold nanocrystals are assembled to a simple hexagonal AlB2 binary superlattice that shows interesting thermal behavior. Finally, superlattices made with alkane thiol-capped sub-2 nm gold nanocrystals are used as model systems to study the superlattice phase transitions. Halide ions are found to be critical for order-to-order structural rearrangements in dodecanethiol-capped 1.9 nm gold nanocrystals superlattices at 190oC. Reversible amorphous-to-crystalline transition upon heating is discovered for octadecanethiol capped 1.66 nm gold nanocrystal superlattices, which is attributed to the ligand melting transition.

In the past several decades, the research on spin transport and magnetism has led to remarkable scientific and technological breakthroughs, including Albert Fert and Peter Grunberg's Nobel Prize-winning discovery of giant magnetoresistance (GMR) in magnetic metallic multilayers. Handbook of Spin Transport and Magnetism provides a comprehensive, bal

Materials development has reached a point where it is difficult for a single material to satisfy the needs of sophisticated applications in the modern world. Nanocomposite films and coatings achieve much more than the simple addition of the constitutents OCo the law of summation fails to work in the nano-world. This book encompasses three major parts of the development of nanocomposite films and coatings: the first focuses on processing and properties, the second concentrates on mechanical performance, and the third deals with functional performance, including wide application areas ranging from mechanical cutting to solar energy and from electronics to medicine. Sample Chapter(s). Chapter 1: Magnetron Sputtered Hard and Yet Tough Nanocomposite Coatings With Case Studies: Nanocrystalline Tin Embedded in Amorphous SiNx (187 KB). Contents: Magnetron Sputtered Hard and Yet Tough Nanocomposite Coatings with Case Studies: Nanocrystalline TiN Embedded in Amorphous SiN x (S Zhang et al.); Magnetron Sputtered Hard and Yet Tough Nanocomposite Coatings with Case Studies: Nanocrystalline TiC Embedded in Amorphous Carbon (S Zhang et al.); Properties of Chemical Vapor Deposited Nanocrystalline Diamond and Nanodiamond/Amorphous Carbon Composite Films (S C Tjong); Synthesis, Characterization and Applications of Nanocrystalline Diamond Films (Z-Q Xu & A Kumar); Properties of Hard Nanocomposite Thin Films (J Musil); Nanostructured, Multifunctional Tribological Coatings (J J Moore et al.); Nanocomposite Thin Films for Solar Energy Conversion (Y-B Yin); Application of Silicon Nanocrystal in Non-Volatile Memory Devices (T P Chen); Nanocrystalline Silicon Films for Thin Film Transistor and Optoelectronic Applications (Y-J Choi et al.); Amorphous and

Nanocomposite Diamond-Like Carbon Coatings for Biomedical Applications (T I T Okpalugo et al.); Nanocoatings for Orthopaedic and Dental Application (W-Q Yan). Readership: Undergraduates, postgraduates, researchers, scientists, college and university professors, research professionals, technology investors and developers, research enterprises, R&D research laboratories, academic and research libraries."

This volume, a reprint from a special issue of the Journal of Nanoparticle Research, draws on work presented at The Second International Symposium on Nanotechnology and Occupational Health, held in Minnesota in 2005. It presents an interdisciplinary approach to nanotechnology and occupational health and offers an overview of recent developments toward assessment and management of hazards and risks associated with engineered nanomaterials.

Nitrogen Compounds—Advances in Research and Application: 2013 Edition is a ScholarlyBrief™ that delivers timely, authoritative, comprehensive, and specialized information about ZZZAdditional Research in a concise format. The editors have built Nitrogen Compounds—Advances in Research and Application: 2013 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about ZZZAdditional Research in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Nitrogen Compounds—Advances in Research and Application: 2013 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

From the Introduction: Nanotechnology and its underpinning sciences are progressing with unprecedented rapidity. With technical advances in a variety of nanoscale fabrication and manipulation technologies, the whole topical area is maturing into a vibrant field that is generating new scientific research and a burgeoning range of commercial applications, with an annual market already at the trillion dollar threshold. The means of fabricating and controlling matter on the nanoscale afford striking and unprecedented opportunities to exploit a variety of exotic phenomena such as quantum, nanophotonic and nanoelectromechanical effects. Moreover, researchers are elucidating new perspectives on the electronic and optical properties of matter because of the way that nanoscale materials bridge the disparate theories describing molecules and bulk matter. Surface phenomena also gain a greatly increased significance; even the well-known link between chemical reactivity and surface-to-volume ratio becomes a major determinant of physical properties, when it operates over nanoscale dimensions. Against this background, this comprehensive work is designed to address the need for a dynamic, authoritative and readily accessible source of information, capturing the full breadth of the subject. Its six volumes, covering a broad spectrum of disciplines including material sciences, chemistry, physics and life sciences, have been written and edited by an outstanding team of international experts. Addressing an extensive, cross-disciplinary audience, each chapter aims to cover key developments in a scholarly, readable and critical style, providing an indispensible first point of entry to the literature for scientists and technologists from interdisciplinary fields. The work focuses on the major classes of nanomaterials in terms of their synthesis, structure and applications,

reviewing nanomaterials and their respective technologies in well-structured and comprehensive articles with extensive cross-references. It has been a constant surprise and delight to have found, amongst the rapidly escalating number who work in nanoscience and technology, so many highly esteemed authors willing to contribute. Sharing our anticipation of a major addition to the literature, they have also captured the excitement of the field itself in each carefully crafted chapter. Along with our painstaking and meticulous volume editors, full credit for the success of this enterprise must go to these individuals, together with our thanks for (largely) adhering to the given deadlines. Lastly, we record our sincere thanks and appreciation for the skills and professionalism of the numerous Elsevier staff who have been involved in this project, notably Fiona Geraghty, Megan Palmer and Greg Harris, and especially Donna De Weerd-Wilson who has steered it through from its inception. We have greatly enjoyed working with them all, as we have with each other.