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### TRENDS IN COMPUTATIONAL NANOMECHANICS

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#### TRANSCENDING LENGTH AND TIME SCALES

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**Springer Science & Business Media** Trends in Computational Nanomechanics reviews recent advances in analytical and computational modeling frameworks to describe the mechanics of materials on scales ranging from the atomistic, through the microstructure or transitional, and up to the continuum. The book presents new approaches in the theory of nanosystems, recent developments in theoretical and computational methods for studying problems in which multiple length and/or time scales must be simultaneously resolved, as well as example applications in nanomechanics. This title will be a useful tool of reference for professionals, graduates and undergraduates interested in Computational Chemistry and Physics, Materials Science, Nanotechnology.

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#### NANO-SCALE HEAT TRANSFER IN NANOSTRUCTURES

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#### TOWARD UNDERSTANDING AND ENGINEERING THERMAL TRANSPORT

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**Springer** The book introduces modern atomistic techniques for predicting heat transfer in nanostructures, and discusses the applications of these techniques on three modern topics. The study of heat transport in screw-dislocated nanowires with low thermal conductivity in their bulk form represents the knowledge base needed for engineering thermal transport in advanced thermoelectric and electronic materials, and suggests a new route to lower thermal conductivity that could promote thermoelectricity. The study of high-temperature coating composite materials facilitates the understanding of the role played by composition and structural characterization, which is difficult to approach via experiments. And the understanding of the impact of deformations, such as bending and collapsing on thermal transport along carbon nanotubes, is important as carbon nanotubes, due to their exceptional thermal and mechanical properties, are excellent material candidates in a variety of applications, including thermal interface materials, thermal switches and composite materials.

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#### NANO AND CELL MECHANICS

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#### FUNDAMENTALS AND FRONTIERS

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**John Wiley & Sons** Research in nano and cell mechanics has received much attention from the scientific community as a result of society needs and government initiatives to accelerate developments in materials, manufacturing, electronics, medicine and healthcare, energy, and the environment. Engineers and scientists are currently engaging in increasingly complex scientific problems that require interdisciplinary approaches. In this regard, studies in this field draw from fundamentals in atomistic scale phenomena, biology, statistical and continuum mechanics, and multiscale modeling and experimentation. As a result, contributions in these areas are spread over a large number of specialized journals, which prompted the Editors to assemble this book. Nano and Cell Mechanics: Fundamentals and Frontiers brings together many of the new developments in the field for the first time, and covers fundamentals and frontiers in mechanics to accelerate developments in nano- and bio-technologies. Key features: • Provides an overview of recent advances in nano and cell mechanics. • Covers experimental, analytical, and computational tools used to investigate biological and nanoscale phenomena. • Covers fundamentals and frontiers in mechanics to accelerate developments in nano- and bio-technologies. • Presents multiscale-multiphysics modeling and experimentation techniques. • Examines applications in materials, manufacturing, electronics, medicine and healthcare. Nano and Cell Mechanics: Fundamentals and Frontiers is written by internationally recognized experts in theoretical and applied mechanics, applied physics, chemistry, and biology. It is an invaluable reference for graduate students of nano- and bio-technologies, researchers in academia and industry who are working in nano and cell mechanics, and practitioners who are interested in learning about the latest analysis tools. The book can also serve as a text for graduate courses in theoretical and applied mechanics, mechanical engineering, materials science, and applied physics.

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#### PROPERTIES OF ALUMINIUM GALLIUM ARSENIDE

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**IET** AlGaAs is the most widely studied and applied of the ternary semiconductors. An international array of 30 experts have contributed under the editorship of a world authority on AlGaAs, Dr. S. Adachi of Gunma University, Japan. Subjects covered: structural, mechanical, elastic, lattice vibrational and thermal properties; band structure; optical properties; electro-optical properties; carrier transport; surfaces, interfaces and contacts; impurity and defect centres; lattice dislocations, 2D carrier transport, real space transfer band offsets and electro-optic effects in AlGaAs/GaAs heterostructures.

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#### HANDBOOK OF ZEOLITE SCIENCE AND TECHNOLOGY

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**CRC Press** The Handbook of Zeolite Science and Technology offers effective analyses of salient cases selected expressly for their relevance to current and prospective research. Presenting the principal theoretical and experimental underpinnings of zeolites, this international effort is at once complete and forward-looking, combining fundamental

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#### SCANNING PROBE MICROSCOPY FOR INDUSTRIAL APPLICATIONS

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#### NANOMECHANICAL CHARACTERIZATION

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**John Wiley & Sons** "This book broadly addresses the use of Scanning Probe Microscopy (SPM) for industrial applications and provides a resource that focuses on the use of SPM for real world applications"--

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#### TRANSMISSION ELECTRON MICROSCOPY

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#### PHYSICS OF IMAGE FORMATION AND MICROANALYSIS

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**Springer** The aim of this book is to outline the physics of image formation, electron specimen interactions and image interpretation in transmission electron microscopy. The book evolved from lectures delivered at the University of Munster and is a revised version of the first part of my earlier book Elektronenmikroskopische Untersuchungs- und Priiparationsmethoden, omitting the part which describes specimen-preparation methods. In the introductory chapter, the different types of electron microscope are compared, the various electron-specimen interactions and their applications are summarized and the most important aspects of high-resolution, analytical and high-voltage electron microscopy are discussed. The optics of electron lenses is discussed in Chapter 2 in order to bring out electron-lens properties that are important for an understanding of the function of an electron microscope. In Chapter 3, the wave optics of electrons and the phase shifts by electrostatic and magnetic fields are introduced; Fresnel electron diffraction is treated using Huygens' principle. The recognition that the Fraunhofer-diffraction pattern is the Fourier transform of the wave amplitude behind a specimen is important because the influence of the imaging process on the contrast transfer of spatial frequencies can be described by introducing phase shifts and envelopes in the Fourier plane. In Chapter 4, the elements of an electron-optical column are described: the electron gun, the condenser

and the imaging system. A thorough understanding of electron-specimen interactions is essential to explain image contrast.

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### MULTISCALE MOLECULAR METHODS IN APPLIED CHEMISTRY

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**Springer Science & Business Media** First-Principles-Based Multiscale, Multiparadigm Molecular Mechanics and Dynamics Methods for Describing Complex Chemical Processes, by A. Jaramillo-Botero, R. Nielsen, R. Abrol, J. Su, T. Pascal, J. Mueller and W. A. Goddard.- Dynamic QM/MM: A Hybrid Approach to Simulating Gas-Liquid Interactions, by S. Yockel and G. C. Schatz.- Multiscale Modelling in Computational Heterogeneous Catalysis, by F. J. Keil.- Real-World Predictions from Ab Initio Molecular Dynamics Simulations, by B. Kirchner, P. J. di Dio and J. Hutter.- Nanoscale Wetting Under Electric Field from Molecular Simulations, by C. D. Daub, D. Bratko and A. Luzar.- Molecular Simulations of Retention in Chromatographic Systems: Use of Biased Monte Carlo Techniques to Access Multiple Time and Length Scales, by J. L. Rafferty, J. I. Siepmann, M. R. Schure.- Thermodynamic Properties for Applications in Chemical Industry via Classical Force Fields, by G. Guevara-Carrion, H. Hasse and J. Vrabec.- Multiscale Approaches and Perspectives to Modeling Aqueous Electrolytes and Polyelectrolytes, by L. Delle Site, C. Holm and N. F. A. van der Vegt.- Coarse-Grained Modeling for Macromolecular Chemistry, by H. A. Karimi-Varzaneh and F. Müller-Plathe.-

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### CARBON NANOTUBES AND GRAPHENE

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**Newnes** Carbon Nanotubes and Graphene is a timely second edition of the original Science and Technology of Carbon Nanotubes. Updated to include expanded coverage of the preparation, purification, structural characterization, and common application areas of single- and multi-walled CNT structures, this work compares, contrasts, and, where appropriate, unitizes CNT to graphene. This much expanded second edition reference supports knowledge discovery, production of impactful carbon research, encourages transition between research fields, and aids the formation of emergent applications. New chapters encompass recent developments in the theoretical treatments of electronic and vibrational structures, and magnetic, optical, and electrical solid-state properties, providing a vital base to research. Current and potential applications of both materials, including the prospect for large-scale synthesis of graphene, biological structures, and flexible electronics, are also critically discussed. Updated discussion of properties, structure, and morphology of biological and flexible electronic applications aids fundamental knowledge discovery Innovative parallel focus on nanotubes and graphene enables you to learn from the successes and failures of, respectively, mature and emergent partner research disciplines High-quality figures and tables on physical and mathematical applications expertly summarize key information – essential if you need quick, critically relevant data

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### STRETCHABLE ELECTRONICS

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**John Wiley & Sons** On a daily basis, our requirements for technology become more innovative and creative and the field of electronics is helping to lead the way to more advanced appliances. This book gathers and evaluates the materials, designs, models, and technologies that enable the fabrication of fully elastic electronic devices that can tolerate high strain. Written by some of the most outstanding scientists in the field, it lays down the undisputed knowledge on how to make electronics withstand stretching. This monograph provides a review of the specific applications that directly benefit from highly compliant electronics, including transistors, photonic devices, and sensors. In addition to stretchable devices, the topic of ultraflexible electronics is treated, highlighting its upcoming significance for the industrial-scale production of electronic goods for the consumer. Divided into four parts covering: \* Theory \* Materials and Processes \* Circuit Boards \* Devices and Applications An unprecedented overview of this thriving area of research that nobody in the field - or intending to enter it - can afford to miss.

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### ADVANCES IN PHOTOVOLTAICS: PART 4

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**Academic Press** Advances in Photovoltaics: Part Four provides valuable information on the challenges faced during the transformation of our energy supply system to more efficient, renewable energies. The volume discusses the topic from a global perspective, presenting the latest information on photovoltaics, a cornerstone technology. It covers all aspects of this important semiconductor technology, reflecting on the tremendous and dynamic advances that have been made on this topic since 1975, when the first book on solar cells—written by Harold J. Hovel of IBM—was published as volume 11 in the now famous series on Semiconductors and Semimetals. Readers will gain a behind the scenes look at the continuous and rapid scientific development that leads to the necessary price and cost reductions in global industrial mass-production. Written by leading, internationally known experts on his topic Provides an in-depth overview of the current status and perspectives of thin film PV technologies Discusses the challenges faced during the transformation of our energy supply system to more efficient, renewable energies Delves deep into photovoltaics, a cornerstone technolog

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### CHEMICAL DYNAMICS IN CONDENSED PHASES

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### RELAXATION, TRANSFER AND REACTIONS IN CONDENSED MOLECULAR SYSTEMS

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**Oxford University Press** Graduate level textbook presenting some of the most fundamental processes that underlie physical, chemical and biological phenomena in complex condensed phase systems. Includes in-depth descriptions of relevant methodologies, and provides ample introductory material for readers of different backgrounds.

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### TRENDS IN NANOSCALE MECHANICS

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### MECHANICS OF CARBON NANOTUBES, GRAPHENE, NANOCOMPOSITES AND MOLECULAR DYNAMICS

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**Springer** This book contains a collection of the state-of-the-art reviews written by the leading researchers in the areas of nanoscale mechanics, molecular dynamics, nanoscale modeling of nanocomposites and mechanics of carbon nanotubes. No other book provides reviews of recent discoveries such as a nanoscale analog of the Pauli's principle, i.e., effect of the spatial exclusion of electrons or the SEE effect, a new Registry Matrix Analysis for the nanoscale interfacial sliding and new data on the effective viscosity of interfacial electrons in nanoscale stiction at the interfaces. This volume is also an exceptional resource on the well tested nanoscale modeling of carbon nanotubes and nanocomposites, new nanoscale effects, unique evaluations of the effective thickness of carbon nanotubes under different loads, new data on which size of carbon nanotubes is safer and many other topics. Extensive bibliography concerning all these topics is included along with the lucid short reviews. Numerous illustrations are provided for molecular dynamic simulations, fascinating nanoscale phenomena and remarkable new effects. It is of interest to a wide range of researchers and students.

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### NANOSTRUCTURED SEMICONDUCTORS

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### AMORPHIZATION AND THERMAL PROPERTIES

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**CRC Press** The book is devoted to nanostructures and nanostructured materials containing both amorphous and crystalline phases with a particular focus on their thermal properties. It is the first time that theoreticians and experimentalists from different domains gathered to treat this subject. It contains two distinct parts; the first combines theory and simulations methods with specific examples, while the second part discusses methods to fabricate nanomaterials with crystalline and amorphous phases and experimental techniques to measure the thermal conductivity of such materials. Physical insights are given in the first part of the book, related with the existing theoretical models and the state of art simulations methods (molecular dynamics, ab-initio simulations, kinetic theory of gases). In the second part, engineering advances in the nanofabrication of crystalline/amorphous heterostructures (heavy ion irradiation, electrochemical etching, aging/recrystallization, ball milling, PVD, laser crystallization and magnetron sputtering) and adequate experimental measurement methods are analyzed (Scanning Thermal Microscopy, Raman, thermal wave methods and x-rays neutrons spectroscopy).

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### MOLECULAR ELECTRONICS

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### AN INTRODUCTION TO THEORY AND EXPERIMENT

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**World Scientific** This book provides a comprehensive overview of the rapidly developing field of molecular electronics. It focuses on our present understanding of the electrical conduction in single-molecule circuits and provides a thorough introduction to the experimental techniques and theoretical concepts. It will also constitute as the first textbook-like introduction to both the experiment and theory of electronic transport through single atoms and molecules. In this sense, this publication will prove invaluable to both researchers and students interested in the field of nanoelectronics and nanoscience in general. Molecular Electronics is self-contained and unified in its presentation. It may be used as a textbook on nanoelectronics by graduate students and advanced undergraduates studying physics and chemistry. In addition, included are previously unpublished material that will help

researchers gain a deeper understanding into the basic concepts involved in the field of molecular electronics.

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## DEEP LEARNING FOR THE LIFE SCIENCES

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### APPLYING DEEP LEARNING TO GENOMICS, MICROSCOPY, DRUG DISCOVERY, AND MORE

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**O'Reilly Media** Deep learning has already achieved remarkable results in many fields. Now it's making waves throughout the sciences broadly and the life sciences in particular. This practical book teaches developers and scientists how to use deep learning for genomics, chemistry, biophysics, microscopy, medical analysis, and other fields. Ideal for practicing developers and scientists ready to apply their skills to scientific applications such as biology, genetics, and drug discovery, this book introduces several deep network primitives. You'll follow a case study on the problem of designing new therapeutics that ties together physics, chemistry, biology, and medicine—an example that represents one of science's greatest challenges. Learn the basics of performing machine learning on molecular data Understand why deep learning is a powerful tool for genetics and genomics Apply deep learning to understand biophysical systems Get a brief introduction to machine learning with DeepChem Use deep learning to analyze microscopic images Analyze medical scans using deep learning techniques Learn about variational autoencoders and generative adversarial networks Interpret what your model is doing and how it's working

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### LENGTH-SCALE DEPENDENT PHONON INTERACTIONS

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**Springer Science & Business Media** This book presents a comprehensive description of phonons and their interactions in systems with different dimensions and length scales. Internationally-recognized leaders describe theories and measurements of phonon interactions in relation to the design of materials with exotic properties such as metamaterials, nano-mechanical systems, next-generation electronic, photonic, and acoustic devices, energy harvesting, optical information storage, and applications of phonon lasers in a variety of fields. The emergence of techniques for control of semiconductor properties and geometry has enabled engineers to design structures in which functionality is derived from controlling electron behavior. As manufacturing techniques have greatly expanded the list of available materials and the range of attainable length scales, similar opportunities now exist for designing devices whose functionality is derived from controlling phonon behavior. However, progress in this area is hampered by gaps in our knowledge of phonon transport across and along arbitrary interfaces, the scattering of phonons with crystal defects, interface roughness and mass-mixing, delocalized electrons/collective electronic excitations, and solid acoustic vibrations when these occur in structures with small physical dimensions. This book provides a comprehensive description of phonons and their interactions in systems with different dimensions and length scales. Theories and measurements of phonon interactions are described in relation to the design of materials with exotic properties such as metamaterials, nano-mechanical systems, next-generation electronic, photonic, and acoustic devices, energy harvesting, optical information storage, and applications of phonon lasers in a variety of fields.

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### ADVANCES IN CARBON NANOMATERIALS

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#### SCIENCE AND APPLICATIONS

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**CRC Press** This book covers the nomenclature and modeling of carbon nanomaterials, includes examples of surfaces and thin films of fullerenes, and examines the morphology and structure of carbon nanotubes and the characterization of peapod materials with the aid of transmission electron microscopy. It also presents electro-optical properties and self-assembly and enrichment in carbon nanotubes, followed by strategies for the chemical functionalization of carbon nanohorns and endohedral metallofullerenes. Finally, the applications of endohedral metallofullerenes in quantum computing and of functionalized carbon nanotubes in medicine conclude this fascinating overview of the field.

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### NANOFERROICS

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**Springer Science & Business Media** This book covers the physical properties of nanosized ferroics, also called nanoferroics. Nanoferroics are an important class of ceramic materials that substitute conventional ceramic ferroics in modern electronic devices. They include ferroelectric, ferroelastic, magnetic and multiferroic nanostructured materials. The phase transitions and properties of these nanostructured ferroics are strongly affected by the geometric confinement originating from surfaces and interfaces. As a consequence, these materials exhibit a behavior different from the corresponding bulk crystalline, ceramic and powder ferroics. This monograph offers comprehensive coverage of size- and shape-dependent effects at the nanoscale; the specific properties that these materials have been shown to exhibit; the theoretical approaches that have been successful in describing the size-dependent effects observed experimentally; and the technological aspects of many chemical and physico-chemical nanofabrication methods relevant to making nanoferroic materials and composites. The book will be of interest to an audience of condensed matter physicists, material scientists and engineers, working on ferroic nanostructured materials, their fundamentals, fabrication and device applications.

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### PHYSICS OF SLIDING FRICTION

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**Springer Science & Business Media** The study of sliding friction is one of the oldest problems in physics, and certainly one of the most important from a practical point of view. Low-friction surfaces are in increasingly high demand for high-tech components such as computer storage systems, miniature motors, and aerospace devices. It has been estimated that about 5% of the gross national product in the developed countries is "wasted" on friction and the related wear. In spite of this, remarkable little is understood about the fundamental, microscopic processes responsible for friction and wear. The topic of interfacial sliding has experienced a major burst of interest and activity since 1987, much of which has developed quite independently and spontaneously. This volume contains contributions from leading scientists on fundamental aspects of sliding friction. Some problems considered are: What is the origin of stick-and-slip motion? What is the origin of the rapid processes taking place within a lub at low sliding velocities? On a metallic surface, is the rication layer electronic or phononic friction the dominating energy dissipation process? What is the role (if any) of self-organized criticality in sliding friction? How thick is the water layer during sliding on ice and snow? These and other questions raised in this book are of course only partly answered: the topic of sliding friction is still in an early state of development.

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### GRAPHDIYNE

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#### FUNDAMENTALS, AND APPLICATIONS IN RENEWABLE ENERGY AND ELECTRONICS

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**John Wiley & Sons** Discover the most cutting-edge developments in the study of graphdiyne from a pioneer of the field In Graphdiyne: Fundamentals and Applications in Renewable Energy and Electronics, accomplished chemist Dr. Yuliang Li delivers a practical and insightful compilation of theoretical and experimental developments in the study of graphdiyne. Of interest to both academics and industrial researchers in the fields of nanoscience, organic chemistry, carbon science, and renewable energies, the book systematically summarizes recent research into the exciting new material. Discover information about the properties of graphdiyne through theoretical simulations and experimental characterizations, as well as the development of graphdiyne with appropriate preparation technology. Learn to create new graphdiyne-based materials and better understand its intrinsic properties. Find out about synthetic methodologies, the controlled growth of aggregated state structures, and structural characterization. In addition to demonstrating the interdisciplinary potential and relevance of graphdiyne, the book also offers readers: A thorough introduction to basic structure and band gap engineering, including molecular and electronic structure, mechanical properties, and the layers structure of bulk graphdiyne Explorations of Graphdiyne synthesis and characterization, including films, nanotube arrays and nanowires, nanowalls, and nanosheets, as well as characterization methods Discussions of the functionalization of graphdiyne, including heteroatom doping, metal decoration, and absorption of guest molecules Rigorous treatments of Graphdiyne-based materials in catalytic applications, including photo- and electrocatalysts Perfect for organic chemists, electronics engineers, materials scientists, and physicists, Graphdiyne: Fundamentals and Applications in Renewable Energy and Electronics will also find its place on the bookshelves of surface and solid-state chemists, electrochemists, and catalytic chemists seeking a one-stop reference on this rising-star carbon material.

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### 2D NANOMATERIALS FOR ENERGY APPLICATIONS

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#### GRAPHENE AND BEYOND

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**Elsevier** 2D Nanomaterials for Energy Applications: Graphene and Beyond discusses the current state-of-the-art of 2D nanomaterials used in energy-related applications. Sections cover nanogenerators, hydrogen storage and theoretical design. Each chapter focuses on a different energy application, thus allowing readers to gain a greater understanding of the most promising 2D materials in the field. The book's ultimate goal lies in describing how each energy technology is beneficial, hence it provides a valuable reference source for materials scientists and engineers. The physical and chemical properties of 2D materials can be effectively tuned through different strategies, such as controlling dimensions, the crystallographic structure and defects, or doping with heteroatoms. This flexibility facilitates the design of 2D materials for dedicated applications in the field of energy conversion and

storage. Offers a single source for the major practical applications of 2D materials in the field of energy conversion and storage. Explores how 2D materials are being used to create new, more efficient industrial energy products and devices. Compares a variety of 2D materials, showing how the properties of a range of these materials make them beneficial for specific energy applications.

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#### ADVANCES IN PHOTOVOLTAICS:

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**Newnes Semiconductors and Semimetals** has distinguished itself through the careful selection of well-known authors, editors, and contributors. Originally widely known as the "Willardson and Beer" Series, it has succeeded in publishing numerous landmark volumes and chapters. The series publishes timely, highly relevant volumes intended for long-term impact and reflecting the truly interdisciplinary nature of the field. 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 academia, scientific laboratories and modern industry. This volume is the second of a set of seven on the topic of photovoltaics. Written and edited by internationally renowned experts Relevant to a wide readership: physicists, chemists, materials scientists, and device engineers in academia, scientific laboratories and modern industry

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#### QUANTUM GASES

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#### FINITE TEMPERATURE AND NON-EQUILIBRIUM DYNAMICS

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**World Scientific** This volume provides a broad overview of the principal theoretical techniques applied to non-equilibrium and finite temperature quantum gases. Covering Bose-Einstein condensates, degenerate Fermi gases, and the more recently realised exciton-polariton condensates, it fills a gap by linking between different methods with origins in condensed matter physics, quantum field theory, quantum optics, atomic physics, and statistical mechanics.

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#### STRUCTURAL NANOCRYSTALLINE MATERIALS

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#### FUNDAMENTALS AND APPLICATIONS

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**Cambridge University Press** Nanocrystalline materials exhibit exceptional mechanical properties, representing an exciting new class of structural materials for technological applications. The advancement of this important field depends on the development of new fabrication methods, and an appreciation of the underlying nano-scale and interface effects. This authored book addresses these essential issues, presenting for the first time a fundamental, coherent and current account at the theoretical and practical level of nanocrystalline and nanocomposite bulk materials and coatings. The subject is approached systematically, covering processing methods, key structural and mechanical properties, and a wealth of applications. This is a valuable resource for graduate students studying nanomaterials science and nanotechnologies, as well as researchers and practitioners in materials science and engineering.

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#### ONE-DIMENSIONAL NANOSTRUCTURES

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**Springer Science & Business Media** One-dimensional (1D) nanostructures, including nanowires, nanotubes and quantum wires, have been regarded as the most promising building blocks for nanoscale electronic and optoelectronic devices. This book presents exciting, state-of-the-art developments in synthesis and properties of 1D nanostructures with many kinds of morphologies and compositions as well as their considerable impact on spintronics, information storage, and the design of field-effect transistors.

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#### ZEOLITES AND CATALYSIS

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#### SYNTHESIS, REACTIONS AND APPLICATIONS

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**John Wiley & Sons** This indispensable two-volume handbook covers everything on this hot research field. The first part deals with the synthesis, modification, characterization and application of catalytic active zeolites, while the second focuses on such reaction types as cracking, hydrocracking, isomerization, reforming and other industrially important topics. Edited by a highly experienced and internationally renowned team with chapters written by the "Who's Who" of zeolite research.

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#### STRUCTURAL NANOCOMPOSITES

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#### PERSPECTIVES FOR FUTURE APPLICATIONS

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**Springer Science & Business Media** Advancements in the nanotechnology industry promise to offer improvements in capabilities across a spectrum of applications. This is of immense strategic importance to the high performance sector which has historically leveraged technological advances. The use of polymer nanocomposites in structures have several predictable impacts on structural design and applications, primarily by providing a safer, faster, and eventually cheaper transportation in the future. This books comprises reviews on the state-of-the-art, new research results, perspectives of future developments, and innovative applications relevant to structural materials, engineering structures, nanocomposites, modelling and simulations, and their related application areas.

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#### DYNAMIC RESPONSE OF ADVANCED CERAMICS

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**John Wiley & Sons** Dynamic Response of Advanced Ceramics Discover fundamental concepts and recent advances in experimental, analytical, and computational research into the dynamic behavior of ceramics In Dynamic Response of Advanced Ceramics, an accomplished team of internationally renowned researchers delivers a comprehensive exploration of foundational and advanced concepts in experimental, analytical, and computational aspects of the dynamic behavior of advanced structural ceramics and transparent materials. The book discusses new techniques used for determination of dynamic hardness and dynamic fracture toughness, as well as edge-on-impact experiments for imaging evolving damage patterns at high impact velocities. The authors also include descriptions of the dynamic deformation behavior of icosahedral ceramics and the dynamic behavior of several transparent materials, like chemically strengthened glass and glass ceramics. The developments discussed within the book have applications in everything from high-speed machining to cutting, grinding, and blast protection. Readers will also benefit from a presentation of emerging trends and directions in research on this subject as well as current challenges in experimental and computational domains, including: An introduction to the history of ceramic materials and their dynamic behavior, including examples of material response to high-strain-rate loading An exploration of high-strain-rate experimental techniques, like 1D elastic stress-wave propagation techniques, shock waves, and impact testing Discussions of the static and dynamic responses of ceramics and the shock response of brittle solids An overview of deformation mechanisms during projectile impact on a confined ceramic, including damage evolution during the nonpenetration and penetration phases. Perfect for researchers, scientists, and engineers working on ballistic impact and shock response of brittle materials, Dynamic Response of Advanced Ceramics will also earn a place in the libraries of industry personnel studying impact-resistant solutions for a variety of applications.

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#### MANUFACTURED FIBRE TECHNOLOGY

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**Springer Science & Business Media** Manufactured Fibre Technology provides an accessible and comprehensive treatment of the chemical, physical and mechanical processes involved in the production of all important commodity manufactured fibres and most of the industrial fibres. The emphasis is on the fundamental principles and industrial aspects of production. Latest developments in manufactured fibres in terms of manufacturing processes, characteristics and their applications are also covered. Manufactured Fibre Technology is designed around twenty chapters with a balance of basic principles and production of specific fibre types. Newer and industrially relevant areas such as high speed spinning, production of speciality fibres (including microfibres), computer simulation of spinning, high performance fibres, spun-bonding and melt-blowing, and re-use of fibre waste are included. The structure, property and application areas of each fibre type are also discussed, thus providing a broad understanding of the subject. In addition, various aspects related to the testing and characterisation of fibres and polymers are reviewed. This book is an invaluable resource to students, lecturers, industrial technologists and researchers in this subject area.

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## HANDBOOK OF SOL-GEL SCIENCE AND TECHNOLOGY

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### PROCESSING, CHARACTERIZATION AND APPLICATIONS

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**Springer** This completely updated and expanded second edition stands as a comprehensive knowledgebase on both the fundamentals and applications of this important materials processing method. The diverse, international team of contributing authors of this reference clarify in extensive detail properties and applications of sol-gel science and technology as it pertains to the production of substances, active and non-active, including optical, electronic, chemical, sensor, bio- and structural materials. Essential to a wide range of manufacturing industries, the compilation divides into the three complementary sections: Sol-Gel Processing, devoted to general aspects of processing and recently developed materials such as organic-inorganic hybrids, photonic crystals, ferroelectric coatings, and photocatalysts; Characterization of Sol-Gel Materials and Products, presenting contributions that highlight the notion that useful materials are only produced when characterization is tied to processing, such as determination of structure by NMR, in-situ characterization of the sol-gel reaction process, determination of microstructure of oxide gels, characterization of porous structure of gels by the surface measurements, and characterization of organic-inorganic hybrid; and Applications of Sol-Gel Technology, covering applications such as the sol-gel method used in processing of bulk silica glasses, bulk porous gels prepared by sol-gel method, application of sol-gel method to fabrication of glass and ceramic fibers, reflective and antireflective coating films, application of sol-gel method to formation of photocatalytic coating films, and application of sol-gel method to bioactive coating films. The comprehensive scope and integrated treatment of topics make this reference volume ideal for R&D scientists and engineers across a wide range of disciplines and professional interests.

### MAGNESIUM TECHNOLOGY 2014

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**Springer** The Magnesium Technology Symposium, the event on which this collection is based, is one of the largest yearly gatherings of magnesium specialists in the world. Papers in this collection represent all aspects of the field, ranging from primary production to applications to recycling. Moreover, papers explore everything from basic research findings to industrialization. This volume covers a broad spectrum of current topics, including alloys and their properties; cast products and processing; wrought products and processing; forming, joining, and machining; corrosion and surface finishing; ecology; and structural applications. In addition, there is coverage of new and emerging applications in such areas as hydrogen storage.

### SPARK PLASMA SINTERING: CURRENT STATUS, NEW DEVELOPMENTS AND CHALLENGES

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#### A REVIEW OF THE CURRENT TRENDS IN SPS

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**Elsevier** Spark Plasma Sintering: Current Status, New Developments and Challenges: A Review of the Current Trends in SPS looks at the progress made in the field of SPS. It includes a review of the scientific mechanisms, materials synthesis and industry applications for this processing technique. Chapters are written by leading experts in the field, encompassing topics surrounding the densification mechanism and microstructure evolution, the classification of high-performance materials, a review of numerical simulation, discussions of new technology advances, such as HP-SPS, flash sintering and related challenges. This book will be useful for researchers, engineers and students within the materials science and engineering fields. Provides significant information on the most relevant research topics currently being addressed by the SPS community Highlights the application of SPS techniques Reviews critical issues that still need to be overcome when utilizing SPS technology

### CARBON NANOTUBES

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#### BASIC CONCEPTS AND PHYSICAL PROPERTIES

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**John Wiley & Sons** Carbon nanotubes are exceptionally interesting from a fundamental research point of view. Many concepts of one-dimensional physics have been verified experimentally such as electron and phonon confinement or the one-dimensional singularities in the density of states; other 1D signatures are still under debate, such as Luttinger-liquid behavior. Carbon nanotubes are chemically stable, mechanically very strong, and conduct electricity. For this reason, they open up new perspectives for various applications, such as nano-transistors in circuits, field-emission displays, artificial muscles, or added reinforcements in alloys. This text is an introduction to the physical concepts needed for investigating carbon nanotubes and other one-dimensional solid-state systems. Written for a wide scientific readership, each chapter consists of an instructive approach to the topic and sustainable ideas for solutions. The former is generally comprehensible for physicists and chemists, while the latter enable the reader to work towards the state of the art in that area. The book gives for the first time a combined theoretical and experimental description of topics like luminescence of carbon nanotubes, Raman scattering, or transport measurements. The theoretical concepts discussed range from the tight-binding approximation, which can be followed by pencil and paper, to first-principles simulations. We emphasize a comprehensive theoretical and experimental understanding of carbon nanotubes including - general concepts for one-dimensional systems - an introduction to the symmetry of nanotubes - textbook models of nanotubes as narrow cylinders - a combination of ab-initio calculations and experiments - luminescence excitation spectroscopy linked to Raman spectroscopy - an introduction to the 1D-transport properties of nanotubes - effects of bundling on the electronic and vibrational properties and - resonance Raman scattering in nanotubes.

### THERMOELECTRICITY

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#### AN INTRODUCTION TO THE PRINCIPLES

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**Courier Corporation** This introductory treatment provides an understanding of the fundamental concepts and principles involved in the study of thermoelectricity in solids and of conduction in general. Aimed at graduate-level students and those interested in basic theory, it will be especially valuable to experimental physicists working in fields connected with electron transport and to theoreticians seeking a survey of thermoelectricity and related questions. Chronicling the early history of thermoelectricity from its discovery to modern times, this text features a considerable amount of experimental data and discusses these findings at length wherever they bear a particular relevance to theory. The author, a well-known authority in this field, draws heavily from his own work on thermoelectrical phenomena as they are observed in the study of metals. Numerous illustrative figures appear throughout the text.

### HANDBOOK OF MATERIALS MODELING

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#### APPLICATIONS: CURRENT AND EMERGING MATERIALS

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**Springer** The Handbook of Materials Modeling, 2nd edition is a six-volume major reference serving a steadily growing community at the intersection of two mainstreams of global research: computational science and materials science and technology. This extensively expanded new edition reflects the significant developments in all aspects of computational materials research over the past decade, featuring progress in simulations at multiple scales and increasingly more realistic materials models. Thematically separated into two mutually dependent sets - "Methods: Theory and Modeling (MTM)" and "Applications: Current and Emerging Materials (ACE)" - the handbook runs the entire gamut from theory and methods to simulations and applications. Readers benefit from its in-depth coverage of a broad methodological spectrum extending from advanced atomistic simulations of rare events to data-driven artificial intelligence strategies for materials informatics in the set MTM, as well as forefront emphasis on materials of far-ranging societal importance such as photovoltaics and energy-relevant oxides, and cutting-edge applications to materials for spintronic devices, graphene, cement, and glasses in the set ACE. The thorough, interconnected coverage of methods and applications, together with a line-up of internationally acclaimed editors and authors, will ensure the Handbook of Material Modeling's standing as an enduring source of learning and inspiration for a global community of computational materials scientists.

### ADVANCED MATERIALS

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#### PHYSICS, MECHANICS AND APPLICATIONS

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**Springer Science & Business Media** Advanced materials are the basis of modern science and technology. This proceedings volume presents a broad spectrum of studies of novel materials covering their processing techniques, physics, mechanics, and applications. The book is concentrated on

nanostructures, ferroelectric crystals, materials and composites, materials for solar cells and also polymeric composites. Nanotechnology approaches, modern piezoelectric techniques and also latest achievements in materials science, condensed matter physics, mechanics of deformable solids and numerical methods are presented. Great attention is devoted to novel devices with high accuracy, longevity and extended possibilities to work in wide temperature and pressure ranges, aggressive media etc. The characteristics of materials and composites with improved properties opening new possibilities of various physical processes, in particular transmission and receipt of signals under water, are described.

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#### **DYNAMIC BEHAVIOR OF MATERIALS, VOLUME 1**

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#### **PROCEEDINGS OF THE 2020 ANNUAL CONFERENCE ON EXPERIMENTAL AND APPLIED MECHANICS**

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**Springer Nature** Dynamic Behavior of Materials, Volume 1 of the Proceedings of the 2020 SEM Annual Conference & Exposition on Experimental and Applied Mechanics, the first volume of seven from the Conference, brings together contributions to this important area of research and engineering. The collection presents early findings and case studies on fundamental and applied aspects of Experimental Mechanics, including papers on: Synchrotron Applications/Advanced Dynamic Imaging Quantitative Visualization of Dynamic Events Novel Experimental Techniques Dynamic Behavior of Geomaterials Dynamic Failure & Fragmentation Dynamic Response of Low Impedance Materials Hybrid Experimental/Computational Studies Shock and Blast Loading Advances in Material Modeling Industrial Applications

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#### **ZEOLITES IN SUSTAINABLE CHEMISTRY**

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#### **SYNTHESIS, CHARACTERIZATION AND CATALYTIC APPLICATIONS**

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**Springer** This book is devoted to the new development of zeolitic catalysts with an emphasis on new strategies for the preparation of zeolites, novel techniques for their characterization and emerging applications of zeolites as catalysts for sustainable chemistry, especially in the fields of energy, biomass conversion and environmental protection. Over the years, energy and the environment have become the most important global issues, while zeolitic catalysts play important roles in addressing them. With individual chapters written by leading experts, this book offers an essential reference work for researchers and professionals in both academia and industry. Feng-Shou Xiao is a Professor at the Department of Chemistry, Zhejiang University, China. Xiangju Meng is an Associate Professor at the Department of Chemistry, Zhejiang University, China.

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#### **MICROMECHANICS AND NANOSCALE EFFECTS**

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#### **MEMS, MULTI-SCALE MATERIALS AND MICRO-FLOWS**

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**Springer Science & Business Media** This volume consists of the state-of-the-art reports on new developments in micromechanics and the modeling of nanoscale effects, and is a companion book to the recent Kluwer volume on nanomechanics and mul- scale modeling (it is entitled Trends in Nanoscale Mechanics). The two volumes grew out of a series of discussions held at NASA Langley Research Center (LaRC), lectures and other events shared by many researchers from the national research laboratories and academia. The key events include the 2001 Summer Series of Round-Table Discussions on Nanotechnology at ICASE Institute (NASA LaRC) organized by Drs. V. M. Harik and M. D. Salas and the 2002 NASA LaRC Workshop on Multi-scale Modeling. The goal of these interactions was to foster collaborations between academic researchers and the ICASE Institute (NASA LaRC), a universi- based institute, which has pioneered world-class computational, theoretical and experimental research in the disciplines that are important to NASA. Editors gratefully acknowledge help of Ms. E. Todd (ICASE, NASA LaRC), the ICASE Director M. D. Salas and all reviewers, in particular, Dr. B. Diskin (ICASE/NIA, NASA LaRC), Prof. R. Haftka (University of Florida), Dr. V. M. Harik (ICASE/Swales Aerospace, NASA LaRC), Prof.