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Nanomaterials **Nanochemistry Nanostructures and Nanomaterials Nanomaterials Handbook Carbon Nanomaterials, Second Edition** Nanostructures & Nanomaterials **Industrial Applications of Nanomaterials Synthesis of Inorganic Nanomaterials** *Nanomaterials* **Plasma Processing of Nanomaterials** Nanomaterials and Their Applications **Nanomaterials** Nanomaterial Characterization *Nanomaterials Recycling* **Nanomaterials and Nanochemistry Nanomaterials, Nanotechnologies and Design Environmental Applications of Nanomaterials** Nanoscience and Nanomaterials **Green Nanomaterials** *Nanomaterials* **Nanomaterials: A Danger or a Promise?** *Design, Fabrication, and Characterization of Multifunctional Nanomaterials* Nanomaterials for Electrocatalysis Nanomaterials **Mixed Metal Nanomaterials Nanomaterials and Nanocomposites 2D Nanomaterials for Energy and Environmental Sustainability Mechanical Properties of Nanomaterials** Nanomaterials, Polymers and Devices Microscopy Methods in Nanomaterials Characterization Nanomaterials for Biosensors **Nanomaterials: Synthesis, Characterization, Hazards and Safety Functionalized Nanomaterials** Nanomaterials **Springer Handbook of Nanomaterials** Sample Preparation with Nanomaterials **Nanomaterials: Evolution and Advancement towards Therapeutic Drug Delivery (Part II) Novel Nanomaterials for Biomedical, Environmental and Energy Applications** Amorphous Nanomaterials Green Functionalized Nanomaterials for Environmental Applications

Nanomaterials are being incorporated into products all around us, having an incredible impact on durability, strength, functionality, and other material properties. There are a vast number of nanomaterials presently available, and new formulations and chemistries are being announced daily. Nanomaterials: A Guide to Fabrication and Applications provides product developers, researchers, and materials scientists with a handy resource for understanding the range of options and materials currently available. Covering a variety of nanomaterials and their applications, this practical reference: Discusses the scale of nanomaterials and nanomachines, focusing on integrated circuits (ICs) and microelectromechanical systems (MEMS) Offers insight into different nanomaterials' interactions with chemical reactions, biological processes, and the environment Examines the mechanical properties of nanomaterials and potential treatments to enhance the nanomaterials' performance Details recent accomplishments in the use of nanomaterials to create new forms of electronic devices Explores the optical properties of certain nanomaterials and the nanomaterials' use in optimizing lasers and optical absorbers Describes an energy storage application as well as how nanomaterials from waste products may be used to improve capacitors Featuring contributions from experts around the globe, Nanomaterials: A Guide to Fabrication and Applications serves as a springboard for the discovery of new applications of nanomaterials. We are at a critical evolutionary juncture in the research and development of low-temperature plasmas, which have become essential to synthesizing and processing vital nanoscale materials. More and more industries are increasingly dependent on plasma technology to develop integrated small-scale devices, but physical limits to growth, and other challenges, threaten progress. Plasma Processing of Nanomaterials is an in-depth guide to the art and science of plasma-based chemical processes used to synthesize, process, and modify various classes of nanoscale materials such as nanoparticles, carbon nanotubes, and semiconductor nanowires. Plasma technology enables a wide range of academic and industrial applications in fields including electronics, textiles, automotives, aerospace, and biomedical. A prime example is the semiconductor industry, in which engineers revolutionized microelectronics by using plasmas to deposit and etch thin films and fabricate integrated circuits. An overview of progress and future potential in plasma processing, this reference illustrates key experimental and theoretical aspects by presenting practical examples of: Nanoscale etching/deposition of thin films Catalytic growth of carbon nanotubes and semiconductor nanowires Silicon nanoparticle synthesis Functionalization of carbon nanotubes Self-organized nanostructures Significant advances are expected in nanoelectronics, photovoltaics, and other emerging fields as plasma technology is further optimized to improve the implementation of nanomaterials with well-defined size, shape, and composition. Moving away from the usual focus on wet techniques embraced in chemistry and physics, the author sheds light on pivotal breakthroughs being made by the smaller plasma community. Written for a diverse audience working in fields ranging from nanoelectronics and energy sensors to catalysis and nanomedicine, this resource will help readers improve development and application of nanomaterials in their own work. About the Author: R. Mohan Sankaran received the American Vacuum Society’s 2011 Peter Mark Memorial Award for his outstanding contributions to tandem plasma synthesis. This book provides information on synthesis, properties, and applications of carbon nanomaterials. With novel materials, such as graphene (atomically flat carbon) or carbon onions (carbon nanospheres), the family of carbon nanomaterials is rapidly growing. This book provides a state-of-the-art overview and in-depth analysis of the most important carbon nanomaterials. Each chapter is written by a leading expert in the field which ensures that both, a review on the subject along with emerging perspectives are provided to the reader. This text focuses on the synthesis, properties and applications of nanostructures and nanomaterials, particularly inorganic nanomaterials. It provides coverage of the fundamentals and processing techniques with regard to synthesis, properties, characterization and applications of nanostructures and nanomaterials. The development of a vector for the delivery of therapeutic drugs in a controlled and targeted fashion is still a major challenge in the treatment of many diseases. The conventional application of drugs may lead to many limitations including poor distribution, limited effectiveness, lack of selectivity and dose dependent toxicity. An efficient drug delivery system can address these problems. Recent nanotechnology advancements in the biomedical field have the potential to meet these challenges in developing drug delivery systems. Nanomaterials are changing the biomedical platform in terms of disease diagnosis, treatment and prevention. Nanomaterials aided drug delivery provides an advantage by enhancing aqueous solubility that leads to improved bioavailability, increased resistance time in the body, decreased side effects by targeting drugs to the specific location, reduced dose dependent toxicity and protection of drugs from early release. In this two-part book, the contributors have compiled reports of recent studies illustrating the promising nanomaterials that can work as drug carriers which can navigate conventional physiological barriers. A detailed account of several types of nanomaterials including polymeric nanoparticles, liposomes, dendrimers, micelles, carbon nanomaterials, magnetic nanoparticles, solid lipid-based nanoparticles, silica nanomaterials and hydrogels for drug delivery is provided in separate chapters. The contributors also present a discussion on clinical aspects of ongoing research with insights towards future prospects of specific nanotechnologies. Part II covers the following topics: · Solid lipid nanoparticles and nanostructured lipid carriers · Silica based nanomaterials · Hydrogels · Metallic nanoparticles · Computational and experimental binding interactions of drug and ?-cyclodextrin · Clinical milestones in nanotherapeutics · Drug delivery systems based on poly(lactide-co-glycolide) and its copolymers The book set is an informative resource for scholars who seek updates in nanomedicine with reference to nanomaterials used in drug delivery systems. In the last decade, nanomaterials have become a double-edged sword. On one hand, nanomaterials have proven their limitless potential not only for technological applications, but also for medical ones. On the other hand, the increasing use of these nanomaterials has raised concerns regarding their safety for environmental and human health, due to their potential toxicity. The toxic effects of nanomaterials depend on their type, surface geometry, diameter, length and function. This book intends to provide a comprehensive evidence-based overview of nanomaterial toxicity, from their synthesis and characterization, environmental impact, tests to assess their toxicity in vitro and in vivo, ways to modulate their impact on living organisms, to their beneficial use in biomedical applications. This timely volume on nanomaterials and their biomedical and environmental applications includes the fundamentals of nanoparticles, and state-of-the-art properties, characterization, and the synthesis methods as well as the applications. The main thrust of the book is to present review chapters that explore all these aspects of nanomaterials for scientists, engineers and students who are fairly new to the field and want to have a deeper understanding of all the recent R & D advances. The 12 chapters are written by subject matter experts and plot the influence of nanomaterials on the analytical systems (macro to micro & lab-on-a-chip) for biomedical and environmental applications. This important book focuses on the synthesis and fabrication of nanostructures and nanomaterials, but also includes properties and applications of nanostructures and nanomaterials, particularly inorganic nanomaterials. It provides balanced and comprehensive coverage of the fundamentals and processing techniques with regard to synthesis, characterization, properties, and applications of nanostructures and nanomaterials. Both chemical processing and lithographic techniques are presented in a systematic and coherent manner for the synthesis and fabrication of 0-D, 1-D, and 2-D nanostructures, as well as special nanomaterials such as carbon nanotubes and ordered mesoporous oxides. The book will serve as a general introduction to nanomaterials and nanotechnology for teaching and self-study purposes. This book focuses on the latest advances in the field of nanomaterials and their applications, and provides a comprehensive overview of the state-of-the-art of research in this rapidly developing field. The book comprises chapters exploring various aspects of nanomaterials. Given the depth and breadth of coverage, the book offers a valuable guide for researchers and students working in the area of nanomaterials. With the increased presence of nanomaterials in commercial products such as cosmetics and sunscreens, fillers in dental fillings, water filtration process, catalysis, photovoltaic cells, bio-detection, a growing public debate is emerging on toxicological and environmental effects of direct and indirect exposure to these materials. Nanomaterials: A Danger or a Promise? forms a balanced overview of the health and environmental issues of nanoscale materials. By considering both the benefits and risks associated with nanomaterials, Nanomaterials: A Danger or a Promise? compiles a complete and detailed image of the many aspects of the interface between nanomaterials and their real-life application. The full cycle of nanomaterials life will be presented and critically assessed to consider and answer questions such as: How are nanomaterials made? What they are used for? What is their environmental fate? Can we make them better? Including coverage of relevant aspects about the toxicity of manufactured nanomaterials, nanomaterials life cycle, exposure issues, Nanomaterials: A Danger or a Promise? provides a comprehensive overview of the actual knowledge in these fields but also presents perspectives for the future development of a safer nanoscience. This comprehensive resource is a key reference for students, researcher, manufacturers and industry professionals alike. Microscopy Methods in Nanomaterials Characterization fills an important gap in the literature with a detailed look at microscopic and X-ray based characterization of nanomaterials. These microscopic techniques are used for the determination of surface morphology and the dispersion characteristics of nanomaterials. This book deals with the detailed discussion of these aspects, and will provide the reader with a fundamental understanding of morphological tools, such as instrumentation, sample preparation and different kinds of analyses, etc. In addition, it covers the latest developments and trends morphological characterization using a variety of microscopes. Materials scientists, materials engineers and scientists in related disciplines, including chemistry and physics, will find this to be a detailed, method-orientated guide to microscopy methods of nanocharacterization. Takes a method-orientated approach that includes case studies that illustrate how to carry out each characterization technique Discusses the advantages and disadvantages of each microscopy characterization technique, giving the reader greater understanding of conditions for different techniques Presents an in-depth discussion of each technique, allowing the reader to gain a detailed understanding of each Discover this timely, comprehensive, and up-to-date exploration of crucial aspects of the use of nanomaterials in analytical chemistry Sample Preparation with Nanomaterials: Next Generation Techniques for Sample Preparation delivers insightful and complete overview of recent progress in the use of nanomaterials in sample preparation. The book begins with an overview of special features of nanomaterials and their applications in analytical sciences. Important types of nanomaterials, like carbon nanotubes and magnetic particles, are reviewed and biological sample preparation and lab-on-a-chip systems are presented. The distinguished author places special emphasis on approaches that tend to green and reduce the cost of sample treatment processes. He also discusses the legal, economical, and toxicity aspects of nanomaterial samples. This book includes extensive reference material, like a complete list of manufacturers, that makes it invaluable for professionals in analytical chemistry. Sample Preparation with Nanomaterials offers considerations of the economic aspects of nanomaterials, as well as the assessment of their toxicity and risk. Readers will also benefit from the inclusion of: A thorough introduction to nanomaterials in the analytical sciences and special properties of nanomaterials for sample preparation An exploration of the mechanism of adsorption and desorption on nanomaterials, including carbon nanomaterials used as adsorbents Discussions of membrane applications of nanomaterials, surface enhanced raman spectroscopy, and the use of nanomaterials for biological sample preparation A treatment of magnetic nanomaterials, lab-on-a-chip nanomaterials, and toxicity and risk assessment of nanomaterials Perfect for analytical chemists, materials scientists, and process engineers, Sample Preparation with Nanomaterials: Next Generation Techniques for Sample Preparation will also earn a place in the libraries of analytical laboratories, universities, and companies who conduct research into nanomaterials and seek a one-stop resource for sample preparation. This book grew out of my desire to understand the mechanics of nanomaterials, and to be able to rationalize in my own mind the variety of topics on which the people around me were doing research at the time. The ?eld of nanomaterials has been growing rapidly since the early 1990s. I- tially, the ?eld was populated mostly by researchers working in the ?elds of synt- sis and processing. These scientists were able to make new materials much faster than the rest of us could develop ways of looking at them (or understanding them). However, a con?uence of interests and capabilities in the 1990s led to the exp- sive growth of papers in the characterization and modeling parts of the ?eld. That con?uence came from three primary directions: the rapid growth in our ability to make nanomaterials, a relatively newfound ability to characterize the nanomate- als at the appropriate length and

time scales, and the rapid growth in our ability to model nanomaterials at atomistic and molecular scales. Simultaneously, the commercial potential of nanotechnology has become app- ent to most high-technology industries, as well as to some industries that are tra- tionally not viewed as high-technology (such as textiles). Much of the rapid growth came through the inventions of physicists and chemists who were able to develop nanotechnology products (nanomaterials) through a dizzying array of routes, and who began to interface directly with biological entities at the nanometer scale. That growth continues unabated. A valuable overview covering important fundamental and applicative aspects of amorphous nanomaterials! Amorphous nanomaterials are very important in non-crystalline solids, which have emerged as a new category of advanced materials. Compared to the crystalline counterpart, amorphous nanomaterials with isotropic nature always exhibit fast ion diffusion, relieved strain, and higher reactivity, enabling such materials to exhibit high performance in mechanics and catalysis, as well as other interesting properties. Amorphous Nanomaterials: Preparation, Characterization, and Applications covers the fundamental concept, synthesis, characterization, properties, and applications of nanoscaled amorphous materials. It starts with the introduction of amorphous materials, then gives a global view of the history, structure, and growth mechanism of amorphous nanomaterials. Subsequently, some powerful techniques to characterize amorphous materials, such as X-ray absorption fine structure spectroscopy, spherical aberration electron microscope, in-situ-Transmission Electron Microscope, Electron Energy Loss Spectroscopy, and some other defect characterization technologies are included. Furthermore, the emerging innovative methods to fabricate well-defined, regularshaped amorphous nanomaterials, including zero-, one-, two-, and three-dimensional amorphous nanomaterials are systematically introduced. The fascinating properties and applications related to amorphous nanomaterials including the applications in electrocatalysis, batteries, supercapacitors, photocatalysis, mechanics, etc., are presented. It will greatly help the researchers to find professional answers related to amorphous materials. Great topic: amorphous nanomaterials are a very large and important field in both academia and industry Comprehensive: in-depth discussion of various important aspects, from both a fundamental and an applied point of view, on the chemistry, physics and technological importance of the amorphous nanomaterials are presented Vitally needed: the understanding of the fundamentals of amorphous nanomaterials is a prerequisite for devising new applications of such materials Highly relevant: amorphous nanomaterials have found specific applications in chemistry, catalysis, physics, sensing, batteries, supercapacitors, and engineering Amorphous Nanomaterials is a vital resource for materials scientists, inorganic and physical chemists, solid state chemists, physicists, catalytic and analytical chemists, as well as organic chemists. Providing an eclectic snapshot of the current state of the art and future implications of the field, Nanomaterials, Polymers, and Devices: Materials Functionalization and Device Fabrication presents topics grouped into three categorical focuses: The synthesis, mechanism and functionalization of nanomaterials, such as carbon nanotubes, graphene, silica, and quantum dots Various functional devices which properties and structures are tailored with emphasis on nanofabrication. Among discussed are light emitting diodes, nanophotonic, nano-optical, and photovoltaic devices Nanoelectronic devices, which include semiconductor, nanotube and nanowire-based electronics, single-walled carbon-nanotube based nanoelectronics, as well as thin-film transistors A comprehensive account of how nanomaterials are synthesized and processed, this book presents the theory and technology of introducing nano-based materials as value-added elements into product manufacturing. It explains the fundamentals of vapor, liquid, solid phase, and biosystem-assisted nanoparticle syntheses, with sufficient analysis of each method to permit decisions on which is most productive, energy efficient and safe. The text then confronts the problems of scaling up from lab-based syntheses to manufacturing and demonstrates how nanomaterials on the shop floor require new protocols of quality assurance and employee and environmental protection. International interest in nanoscience research has flourished in recent years, as it becomes an integral part in the development of future technologies. The diverse, interdisciplinary nature of nanoscience means effective communication between disciplines is pivotal in the successful utilization of the science. Nanochemistry: A Chemical Approach to Nanomaterials is the first textbook for teaching nanochemistry and adopts an interdisciplinary and comprehensive approach to the subject. It presents a basic chemical strategy for making nanomaterials and describes some of the principles of materials self-assembly over 'all' scales. It demonstrates how nanometre and micrometre scale building blocks (with a wide range of shapes, compositions and surface functionalities) can be coerced through chemistry to organize spontaneously into unprecedented structures, which can serve as tailored functional materials. Suggestions of new ways to tackle research problems and speculations on how to think about assembling the future of nanotechnology are given. Primarily designed for teaching, this book will appeal to graduate and advanced undergraduate students. It is well illustrated with graphical representations of the structure and form of nanomaterials and contains problem sets as well as other pedagogical features such as further reading, case studies and a comprehensive bibliography. Nanomaterials and nanostructures are the original product of nanotechnology, and the key building blocks for enabling technologies. In this context, this book presents a concise overview of the synthesis and characterization methods of nanomaterials and nanostructures, while integrating facets of physics, chemistry, and engineering. The book summarizes the fundamentals and technical approaches in synthesis, and processing of nanostructures and nanomaterials, so as the reader can have a systematic and quick picture of the field. This book focuses on functional aspects of nanomaterials that have a high relevance to immediate applications, such as catalysis, energy harvesting, biosensing, and surface functionalization. There are chapters addressing nanostructured materials and composites and covering basic properties and requirements of this new class of engineered materials. Nanomaterial Recycling provides an update on the many benefits nanomaterials can provide on both environmental and economic issues. Sections cover the appropriate recycling strategies of nanowastes, nanowaste regulations (including nanowaste disposal and recycling standards), promising applications (reuses) of these recycled nanomaterials, and various methods used for the separation of nanoparticles, including (i) centrifugation, (ii)solvent evaporation, (iii) magnetic separation, (iv) using pH/thermal responsive materials, (v) molecular antisolvents, (vi) nanostructured colloidal solvents, and more. This book is an important reference source for materials scientists and engineers who are seeking to increase their understanding of nanomaterials, recycling processes and techniques. As nanomaterials can be recycled from both new/pure products (from nano manufacturing) and used products (nano waste: waste from nano integrated products), this book is a welcomed addition to many disciplines. Provides information on how nanoscale recycling techniques can mitigate the most hazardous effects of nanomaterials Explains the major recycling processes and techniques used for nanoscale materials Assesses the major challenges of implementing nanoscale recycling approaches in a scalable and cost-effective manner Nanomaterials are defined as materials in which at least one length dimension is below 100 nanometers. In this size regime, these materials exhibit particular - and tunable - optical, electrical or mechanical properties that are not present at the macro-scale. This opens up the possibility for a plethora of applications at the interface of materials, chemistry, physics and biology, many of which have already entered the commercial realm. When nanomaterials are blended with other materials not necessarily in the nanometer regime, the resulting nanocomposites can exhibit dramatically different properties than the bulk material alone, leading to an enhanced performance in terms of, for example, increased thermal and mechanical stability. This book presents the synthesis, characterization and applications of nanomaterials and nanocomposites, covering zero-dimensional, elemental nanoparticles, one-dimensional materials such as nanorods and nanowhiskers, two-dimensional materials such as graphene and boron nitride as well as three-dimensional materials such as fullerenes, polyhedral oligomers and zeolites, complemented by bio-based nanomaterials, e.g., cellulose, chitin, starch and proteins. Introductory chapters on the state-of-the-art of nanomaterial research and the chemistry and physics in nanoscience and nanotechnology round off the book. Here is a brilliant book that covers the major aspects of nanomaterials production. It integrates the many and varied chemical, material and thermo-dynamical facets of production, offering readers a new and unique approach to the subject. The mechanical, optical, and magnetic characteristics of nanomaterials are also presented in detail. Nanomaterials are a fast developing field of research and this book serves as both a reference work for researchers and a textbook for graduate students. The Springer Handbook of Nanomaterials covers the description of materials which have dimension on the "nanoscale". The description of the nanomaterials in this Handbook follows the thorough but concise explanation of the synergy of structure, properties, processing and applications of the given material. The Handbook mainly describes materials in their solid phase; exceptions might be e.g. small sized liquid aerosols or gas bubbles in liquids. The materials are organized by their dimensionality. Zero dimensional structures collect clusters, nanoparticles and quantum dots, one dimensional are nanowires and nanotubes, while two dimensional are represented by thin films and surfaces. The chapters in these larger topics are written on a specific materials and dimensionality combination, e.g. ceramic nanowires. Chapters are authored by well-established and well-known scientists of the particular field. They have measurable part of publications and an important role in establishing new knowledge of the particular field. Nanomaterials are being incorporated into products all around us, having an incredible impact on durability, strength, functionality, and other material properties. There are a vast number of nanomaterials presently available, and new formulations and chemistries are being announced daily. Nanomaterials: A Guide to Fabrication and Applications provides product developers, researchers, and materials scientists with a handy resource for understanding the range of options and materials currently available. Covering a variety of nanomaterials and their applications, this practical reference: Discusses the scale of nanomaterials and nanomachines, focusing on integrated circuits (ICs) and microelectromechanical systems (MEMS) Offers insight into different nanomaterials’ interactions with chemical reactions, biological processes, and the environment Examines the mechanical properties of nanomaterials and potential treatments to enhance the nanomaterials’ performance Details recent accomplishments in the use of nanomaterials to create new forms of electronic devices Explores the optical properties of certain nanomaterials and the nanomaterials’ use in optimizing lasers and optical absorbers Describes an energy storage application as well as how nanomaterials from waste products may be used to improve capacitors Featuring contributions from experts around the globe, Nanomaterials: A Guide to Fabrication and Applications serves as a springboard for the discovery of new applications of nanomaterials. How could nanotechnology not perk the interest of any designer, engineer or architect? Exploring the intriguing new approaches to design that nanotechnologies offer, Nanomaterials, Nanotechnologies and Design is set against the sometimes fantastic sounding potential of this technology. Nanotechnology offers product engineers, designers, architects and consumers a vastly enhanced palette of materials and properties, ranging from the profound to the superficial. It is for engineering and design students and professionals who need to understand enough about the subject to apply it with real meaning to their own work. * World-renowned author team address the hot-topic of nanotechnology * The first book to address and explore the impacts and opportunities of nanotech for mainstream designers, engineers and architects * Full colour production and excellent design: guaranteed to appeal to everyone concerned with good design and the use of new materials Nanomaterials contain some unique properties due to their nanometric size and surface functionalization. Nanomaterial functionalization also affects their compatibility to biocompatibility and toxicity behaviors. environment and living organism. This makes functionalized nanomaterials a material with huge scope and few challenges. This book provides detailed information about the nanomaterial functionalization and their application. Recent advancements, challenges and opportunities in the preparation and applications of functionalized nanomaterials are also highlighted. This book can serve as a reference book for scientific investigators, doctoral and post-doctoral scholars; undergrad and grad. This book is very useful for multidisciplinary researchers, industry personnel’s, journalists, and policy makers. Features: Covers all aspects of Nanomaterial functionalization and its applications Describes and methods of functionalized nanomaterials synthesis for different applications Discusses the challenges, recent findings, and cutting-edge global research trends on functionalization of nanomaterials and its applications It discusses the regulatory frameworks for the safe use of functionalized nanomaterials. It contains contributions from international experts from multiple disciplines. This title features 11 new chapters unique to this edition, including chapters on grain boundaries in graphene, 2D metal carbides and carbonitrides, mechanics of carbon nanotubes and nanomaterials, biomedical applications, oxidation and purification of carbon nanostructures, sintering of nanoceramics, hydrothermal processing, nanofibers, and nanomaterials safety. It offers a comprehensive approach with a focus on inorganic and carbon-based nanomaterials, including fundamentals, applications, synthesis, and characterization. This book also provides a unique angle from the nanomaterial point of view on application, synthesis, and characterization not found in any other nanomaterials book on the market. Green nanomaterials are classed as nanomaterials with no environmentally harmful, toxic, properties. The photocatalysis of nanomaterials involves photo-conduction value in efficient removal/degradation of noxious pollutants. Green nanotechnology has objectives for the development of products and processes which are environmentally friendly, economically sustainable, safe, energy-efficient, and produce little waste or emissions. Such products and processes are based on renewable materials and/or have a low net impact on the environment. Green functionalized nanomaterials, formed by a combination of nanomaterials with natural materials or are derived through a green source, are the new trends in the remediation of pollutants in environmental industries. This has the effect of making photoactive nanomaterials work under UV/sunlight radiation in order to produce reactive radical species that rapidly remove pollutants by redox mechanism. Green Functionalized Nanomaterials for Environmental Applications focuses on recent developments in the area of fabrication of green nanomaterials and their properties. It also looks at ways of lowering the risk of exposure of green functionalized nanomaterials. This needs to be pursued in the future for investigating and assessing health risks, which may be due to exposure to green nanomaterials. It is an important reference source for all those seeking to improve their understanding of how green functionalized nanomaterials are being used in a range of environmental applications, as well as considering potential toxicity implications. Highlights innovative industrial technologies for green functionalized nanomaterials Covers major fabrication techniques for sustainable functionalized nanomaterials Shows how sustainable functionalized nanomaterials are being developed for commercial applications Nanomaterials for Electrocatalysis provides an overview of the different types of nanomaterials, design principles and synthesis protocols used for electrocatalytic reactions. The book is divided into four parts that thoroughly describe basic principles and fundamental of electrocatalysis, different types of nanomaterials used, and their electrocatalytic applications, limitations and future perspectives. As electrochemical systems containing nanomaterials, with relevance to experimental situation, yield better results, this book highlights new information and findings. Provides an overview of nanomaterials applications for electrocatalytic processes, such as oxygen reduction reaction (ORR), oxygen evolution reaction (OER), hydrogen evolution reaction (HER) and CO2 reduction reaction (CO2RR) Provides information on the design and development of various nanomaterials appropriate for electrocatalytic applications Assesses the challenges of manufacturing

nanomaterials at an industrial scale for electronic applications This book comprises a collection of chapters on advances in green nanomaterials. The book looks at ways to establish long?term safe and sustainable forms of nanotechnology through implementation of nanoparticle biosynthesis with minimum impact on the ecosystem. The book looks at synthesis, processing, and applications of metal and metal oxide nanomaterials and also at bio-nanomaterials. The contents of this book will prove useful for researchers and professionals working in the field of nanomaterials and green technology. Design, Fabrication, and Characterization of Multifunctional Nanomaterials covers major techniques for the design, synthesis, and development of multifunctional nanomaterials. The chapters highlight the main characterization techniques, including X-ray diffraction, scanning electron microscopy, high-resolution transmission electron microscopy, energy dispersive X-ray spectroscopy, and scanning probe microscopy.The book explores major synthesis methods and functional studies, including: Brillouin spectroscopy; Temperature-dependent Raman spectroscopic studies; Magnetic, ferroelectric, and magneto-electric coupling analysis; Organ-on-a-chip methods for testing nanomaterials; Magnetron sputtering techniques; Pulsed laser deposition techniques; Positron annihilation spectroscopy to prove defects in nanomaterials; Electroanalytic techniques. This is an important reference source for materials science students, scientists, and engineers who are looking to increase their understanding of design and fabrication techniques for a range of multifunctional nanomaterials. Explains the major design and fabrication techniques and processes for a range of multifunctional nanomaterials; Demonstrates the design and development of magnetic, ferroelectric, multiferroic, and carbon nanomaterials for electronic applications, energy generation, and storage; Green synthesis techniques and the development of nanofibers and thin films are also emphasized. Industrial Applications of Nanomaterials explains the industry based applications of nanomaterials, along with their environmental impacts, lifecycle analysis, safety and sustainability. This book brings together the industrial applications of nanomaterials with the incorporation of various technologies and areas, covering new trends and challenges. Significant properties, safety and sustainability and environmental impacts of synthesis routes are also explored, as are major industrial applications, including agriculture, medicine, communication, construction, energy, and in the military. This book is an important information source for those in research and development who want to gain a greater understanding of how nanotechnology is being used to create cheaper, more efficient products. Explains how different classes of nanomaterials are being used to create cheaper, more efficient products Explores the environmental impacts of using a variety of nanomaterials Discusses the challenges faced by engineers looking to integrate nanotechnology in new product development This book presents cutting-edge research, recent breakthroughs, and unresolved challenges associated with 2D nanomaterials to combat energy and environmental issues. The book discusses the state-of-the-art design and innovations engaged to novel 2D nanomaterials, viz. Transition metal compounds (TMDs, TMOs, TMHs), MXenes, elemental 2D analogs (silicene, phosphorene, arsenene, etc.), Metal-organic frameworks (MOFs), etc. It presents the latest trends on top-down and bottom-up synthesis approaches and properties followed by the critical status and progress of these 2D nanomaterials in the field of energy and environment. The topics cover wide spectrum of 2D nanomaterials applications including energy storage/conversion, air/water/soil remediation, adsorption, photocatalytic degradation, desalination and membrane filtration, detection and sensing, drug delivery systems, and nano-encapsulated agro-formulations. The subsequent section includes a comprehensive account on the safety risk assessment of 2D nanomaterials towards the ecosystem and human health. This book will be beneficial for beginners, researchers, and professionals from diverse fields interested in 2D nanomaterials for energy and environmental sustainability. The book series Nanomaterials for the Life Sciences, provides an in-depth overview of all nanomaterial types and their uses in the life sciences. Each volume is dedicated to a specific material class and covers fundamentals, synthesis and characterization strategies, structure-property relationships and biomedical applications. The series brings nanomaterials to the Life Scientists and life science to the Materials Scientists so that synergies are seen and developed to the fullest. Written by international experts of various facets of this exciting field of research, the series is aimed at scientists of the following disciplines: biology, chemistry, materials science, physics, bioengineering, and medicine, together with cell biology, biomedical engineering, pharmaceutical chemistry, and toxicology, both in academia and fundamental research as well as in pharmaceutical companies. VOLUME 3 - Mixed Metal Nanomaterials This volume covers the aspects of synthesis, characterization and application of bimetallic and multielemental spherical and anisotropic nanomaterials in the life sciences. Nanomaterial Characterization Providing various properties of nanomaterials and the various methods available for their characterization Over the course of the last few decades, research activity on nanomaterials has gained considerable press coverage. The use of nanomaterials has meant that consumer products can be made lighter, stronger, esthetically more pleasing, and less expensive. The significant role of nanomaterials in improving the quality of life is clear, resulting in faster computers, cleaner energy production, target-driven pharmaceuticals, and better construction materials. It is not surprising, therefore, that nanomaterial research has really taken off, spanning across different scientific disciplines from material science to nanotoxicology. A critical part of any nanomaterial research, however, is the need to characterize physicochemical properties of the nanomaterials, which is not a trivial matter. Nanomaterial Characterization: An Introduction is dedicated to understanding the key physicochemical properties and their characterization methods. Each chapter begins by giving an overview of the topic before a case study is presented. The purpose of the case study is to demonstrate how the reader may make use of the background information presented to them and show how this can be translated to solve a nanospecific application scenario. Thus, it will be useful for researchers in helping them design experimental investigations. The book begins with a general overview of the subject, thus giving the reader a solid foundation to nanomaterial characterization. Nanomaterial Characterization: An Introduction features: Nanomaterial synthesis and reference nananomaterials Key physicochemical properties and their measurements including particle size distribution by number, solubility, surface area, surface chemistry, mechanical/tribological properties, and dustiness Scanning tunneling microscopy methods operated under extreme conditions Novel strategy for biological characterization of nanomaterial methods Methods to handle and visualize multidimensional nanomaterial characterization data The book is written in such a way that both students and experts in other fields of science will find the information useful, whether they are in academia, industry, or regulation, or those whose analytical background may be limited.There is also an extensive list of references associated with every chapter to encourage further reading. Nanomaterials for Biosensors: Fundamentals and Applications provides a detailed summary of the main nanomaterials used in biosensing and their application. It covers recent developments in nanomaterials for the fabrication of biosensor devices for healthcare diagnostics, food freshness and bioprocessing. The various processes used for synthesis and characterization of nanostructured materials are examined, along with the design and fabrication of bioelectronic devices using nanostructured materials as building blocks. Users will find the fundamentals of the main nanomaterials used in biosensing, helping them visualize a systematic and coherent picture of how nanomaterials are used in biosensors. The book also addresses the role of bio-conjugation of nanomaterials in the construction of nano-biointerfaces for application in biosensors. Such applications, including metal nanoparticles, metal oxide nanoparticles, nanocomposites, carbon nanotubes, conducting polymers and plasmonic nanostructures in biosensing are discussed relative to each nanomaterial concerned. Finally, recent advancements in protein functionalized nanomaterials for cancer diagnostics and bio-imaging are also included. Provides a detailed study on how nanomaterials are used to enhance sensing capabilities in biosensors Explains the properties, characterization methods and preparation techniques of the nanomaterials used in biosensing Arranged in a material-by-material way, making it clear how each nanomaterial should be used This book contains an overview of novel synthesis, characterization, and applications of nanomaterials. Based on an extensive state-of-the-art literature survey and the results obtained by researchers during the past years, this book presents techniques and special applications of classical and modern nanomaterials focus on environmental remediation and preservation. It summarizes up-to-date synthesis and characterization of diverse materials applied to the modern environment concerns such as zero-valent iron soil remediation, photochromic materials for water treatment, carbon nanotubes for gas sensing, photocatalysis, among others. This book is aimed at students, researchers, and engineers who seek general scientific knowledge about nanomaterials with an application-oriented approach. This book highlights the mechanical properties of nanomaterials produced by several techniques for various applications. The dislocations observed in specimens obtained in nanomaterials are discussed on the chapter about deformation process. Partial dislocations and grain boundary sliding deformation phenomena in nanomaterial specimens are also deeply discussed. Tests for tension, compression, and hardness are described. The behavior of nanomaterials is compared to macrosize specimens, and the results obtained for different fabrication methods are also compared. The special characteristics of nanomaterials are summarized at the end of the book. Synthesis of Inorganic Nanomaterials: Advances and Key Technologies discusses the latest advancements in the synthesis of various types of nanomaterials. The book's main objective is to provide a comprehensive review regarding the latest advances in synthesis protocols that includes up-to-date data records on the synthesis of all kinds of inorganic nanostructures using various physical and chemical methods. The synthesis of all important nanomaterials, such as carbon nanostructures, Core-shell Quantum dots, Metal and metal oxide nanostructures, Nanoferrites, polymer nanostructures, nanofibers, and smart nanomaterials are discussed, making this a one-stop reference resource on research accomplishments in this area. Leading researchers from industry, academia, government and private research institutions across the globe have contributed to the book. Academics, researchers, scientists, engineers and students working in the field of polymer nanocomposites will benefit from its solutions for material problems. Provides an up-to-date data record on the synthesis of all kinds of organic and inorganic nanostructures using various physical and chemical methods Presents the latest advances in synthesis protocols Includes the latest techniques used in the physical and chemical characterization of nanomaterials Covers the characterization of all the important materials groups, such as carbon nanostructures, core-shell quantum dots, metal and metal oxide nanostructures, Nano ferrites, polymer nanostructures and nanofibers Novel Nanomaterials for Biomedical, Environmental, and Energy Applications is a comprehensive study on the cutting-edge progress in the synthesis and characterization of novel nanomaterials and their subsequent advances and uses in biomedical, environmental and energy applications. Covering novel concepts and key points of interest, this book explores the frontier applications of nanomaterials. Chapters discuss the overall progress of novel nanomaterial applications in the biomedical, environmental and energy fields, introduce the synthesis, characterization, properties and applications of novel nanomaterials, discuss biomedical applications, and cover the electrocatalytical and photothermal effects of novel nanomaterials for efficient energy applications. The book will be invaluable to academic researchers and biomedical clinicians working with nanomaterials. Offers comprehensive details on novel and emerging nanomaterials Presents a comprehensive view of new and emerging tactics for the synthesis of efficient nanomaterials Describes and monitors the functions of applications of new and emerging nanomaterials in the biomedical, environmental and energy fields Nanomaterials: Synthesis, Characterization, Hazards and Safety explains the fundamental properties of nanomaterials, covering their types and classifications. The book includes methods of preparation and characterization of nanostructured materials. It explains the principles and fundamentals of nanomaterials, with information on both pure and composite-based materials with e nanostructures, outlines the latest developments and advances in nanomaterials, and highlights toxic effects and protection. This book is designed to appeal to a wide readership of academic and industrial researchers, focusing on nanotechnology and nanomaterials, sustainable chemistry, energy conversion and storage, nanotechnology, chemical engineering, environmental protection, optoelectronics, sensors, and surface and interface science. Provides information on major concepts and advances made in the areas of nanomaterials properties and nano safety Identifies the major physiochemical properties of nanomaterials Explores the toxicity of different class of nanomaterials and how they can be used safely

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