

Nanocomposites Synthesis Structure Properties And New

Nanocomposites are attractive to researchers both from practical and theoretical point of view because of combination of special properties. Many efforts have been made in the last two decades using novel nanotechnology and nanoscience knowledge in order to get nanomaterials with determined functionality. This book focuses on polymer nanocomposites and their possible divergent applications. There has been enormous interest in the commercialization of nanocomposites for a variety of applications, and a number of these applications can already be found in industry. This book comprehensively deals with the divergent applications of nanocomposites comprising of 22 chapters.

The main aims of this book are to summarize the fundamentals, synthesis methods, properties and applications of nanomaterials, so as to provide readers with a systematic knowledge on nanomaterials. In addition, the book covers most commonly used characterization tools pertaining to nanomaterials. Further, it deals with relevant aspects of nanocomposites which contains dispersion of nano-sized particulates, and carbon nanotubes (CNTs) in the matrices (polymer, metal and ceramic). It also discusses development of smart nano textiles (intelligent textiles), self-cleaning glass, sensors, actuators, ferro-fluids, and wear resistant nano coatings. Aimed at senior undergraduate and graduate students, the key features on this book include: Top-down and bottom-up approaches for the synthesis of nanomaterials included Illustrates sample preparation and basic principle of characterization tools for nanomaterials Explains calculation of ratios of surface area to volume and surface atoms to bulk atoms Reviews synthesis, properties and applications of carbon nanotubes and magnetic nanomaterials Discusses size effect on thermal, mechanical, optical, magnetic and electrical properties

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 provides a comprehensive collection of the latest information on nanomaterials and nanocomposites. It covers material synthesis, processing, structure characterization, properties and applications. It presents a coherent treatment of how composite properties depend on nanostructure, and covers cutting-edge topics like bionanocomposites for sustainable development. This book summarizes many developments in the field making it an ideal resource for researchers from industry, academia, government and private research institutions.

Hybrid Polymer Composite Materials: Volume 1: Structure and Chemistry presents the latest on these composite materials that can best be described as materials that are comprised of synthetic polymers and biological/inorganic/organic derived constituents. The combination of unique properties that emerge as a consequence of the particular arrangement and interactions between the different constituents provides immense opportunities for advanced material technologies. This series of four volumes brings an interdisciplinary effort to accomplish a more detailed understanding of the interplay between synthesis, structure, characterization, processing, applications, and performance of these advanced materials, with this volume focusing on their structure and chemistry. Provides a clear understanding of the present state-of-the-art and the growing utility of hybrid polymer composite materials Includes contributions from world renowned experts and discusses the combination of different kinds of materials procured from diverse resources Discusses their synthesis, chemistry, processing, fundamental properties, and applications Provides insights on the potential of hybrid polymer composite materials for advanced applications

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 probe 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.

Nanocomposite Membrane Technology: Fundamentals and Applications is the first book to deliver an extensive exploration of nanocomposite membrane technology. This groundbreaking text offers an eloquent introduction to the field as well as a comprehensive overview of fundamental aspects and application areas. Approaching the subject from the material

Nanocrystalline Materials Their Synthesis-Structure-Property Relationships and Applications Newnes

An excellent, unique, and up-to-date reference book on polyoxymethylene, its compounds, and nanocomposites, specifically dealing with synthesis, characterization, processing, morphology, and applications Polyoxymethylene Handbook: Structure, Properties, Applications, and Their Nanocomposites summarizes many of the state-of-the-art technological and research accomplishments in the area of polyoxymethylene (POM). It discusses in length the polymerization and manufacture of polyoxymethylene and various types of additives, as well as the structure and crystallization behavior of POM and its thermal, physical, mechanical, flame retardant, chemical, electrical, and optical properties. The environmental impact of POM is also addressed. The 15 chapters in the handbook are written by prominent researchers from industry, academia, and government/private research laboratories across the globe. Because so few books have ever been published on polyoxymethylene, the handbook is a very valuable reference tool that truly serves as a "one stop" resource for readers and users seeking solutions to both fundamental and applied problems.

Understanding surfaces and interfaces is a key challenge for those working on hybrid nanomaterials and where new imaging and analysis spectroscopy/electron microscopy responses are

vital. The variability and site recognition of biopolymers, such as DNA molecules, offer a wide range of opportunities for the self-organization of wire nanostructures into much more complex patterns, while the combination of 1D nanostructures consisting of biopolymers and inorganic compounds opens up a number of scientific and technological opportunities. This book discusses the novel synthesis of nanomaterials and their hybrid composites; nanobiocomposites; transition metal oxide nanocomposites; spectroscopic and electron microscopic studies; social, ethical, and regulatory implications of various aspects of nanotechnology; and significant foreseeable applications of some key hybrid nanomaterials. The book also looks at how technology might be used in the future, estimating, where possible, the likely timescales in which the most far-reaching applications of technology might become a reality. Current research trends and potential future advances, such as nanomaterials, nanometrology, electronics, optoelectronics, and nanobiotechnology, are discussed, in addition to the benefits they are currently providing in the short, medium, and long terms. Furthermore, the book explains the current and possible future industrial applications of nanotechnology, examines some of the barriers to its adoption by industry, and identifies what environmental, health and safety, ethical, or societal implications or uncertainties may arise from the use of the technology, both current and future.

This book describes the different methodologies for producing and synthesizing silver nanoparticles (AgNPs) of various shapes and sizes. It also provides an in-depth understanding of the new methods for characterizing and modifying the properties of AgNPs as well as their properties and applications in various fields. This book is a useful resource for a wide range of readers, including scientists, engineers, doctoral and postdoctoral fellows, and scientific professionals working in specialized fields such as medicine, nanotechnology, spectroscopy, analytical chemistry diagnostics, and plasmonics.

Nanomaterials and Polymer Nanocomposites: Raw Materials to Applications brings together the most recent research in nanoparticles and polymer nanocomposites for a range of applications. The book's coverage is comprehensive, starting with synthesis techniques, then moving to characterization and applications of several different classes of nanomaterial and nanoparticle in nanocomposites. By presenting different nanomaterials, such as metal and metal oxides, clay and POSS, carbon nanotubes, cellulose and bio-based polymers in a structured manner, the book enables an efficient comparison of properties and capabilities for these advanced materials, making it relevant both for researchers in an academic environment and also industrial R&D. This book is particularly distinctive because it centers on the raw materials on which the nanocomposites are based, the biological properties of the range of materials discussed, and the environmental and economic considerations of different polymer systems. Presents a thorough, up-to-date review of the latest advances and developments in the field of nanomaterials and polymer nanocomposites, with a particular focus on raw materials Includes comprehensive coverage from historical backgrounds, synthesis techniques, characterization, and a detailed look at new and emerging applications for polymer nanocomposites Provides a range of different material classes, including metal and metal oxides, biopolymers, graphene and cellulose, among others

Covering fundamentals through applications, this book discusses environmentally friendly polymer nanocomposites and alternatives to traditional nanocomposites through detailed reviews of a variety of materials procured from different resources, their synthesis, and applications using alternative green approaches. The text: Describes green polymeric nanocomposites that show greater properties in terms of degradability, biocompatibility, synthesis process, cost effectiveness, mechanical strength, high surface area, nontoxicity, and environmental friendliness Explains the basics of eco-friendly polymer nanocomposites from different natural resources and their chemistry Discusses practical applications that present future directions in the biomedical, pharmaceutical, and automotive industries This book is aimed at scientists, researchers, and academics working in nanotechnology, biomaterials, polymer science, and those studying products derived from eco-friendly nanomaterials.

Biopolymeric Nanomaterials: Fundamentals and Applications outlines the fundamental design concepts and emerging applications of biopolymeric nanomaterials. The book also provides information on emerging applications of biopolymeric nanomaterials, including in biomedicine, manufacturing and water purification, as well as assessing their physical, chemical and biological properties. This is an important reference source for materials scientists, engineers and biomedical scientists who are seeking to increase their understanding of how polymeric nanomaterials are being used for a range of biomedical and industrial applications. Biopolymeric nanomaterials refer to biocompatible nanomaterials, consisting of biopolymers, such as protein (silk, collagen, gelatin, β -casein, zein, and albumin), protein-mimicked polypeptides and polysaccharides (chitosan, alginate, pullulan, starch, and heparin). Biopolymeric nanomaterials may be used as i) delivery systems for bioactive compounds in food application, (ii) for delivery of therapeutic molecules (drugs and genes), or for (iii) tissue engineering. Provides information on the design concepts and synthesis of biopolymeric nanomaterials in biomedical and industrial applications Highlights the major properties and processing methods for biopolymeric nanomaterials Assesses the major challenges of producing biopolymeric nanomaterials on an industrial scale

Metal Oxide Nanocomposites: Synthesis and Applications summarizes many of the recent research accomplishments in the area of metal oxide-based nanocomposites. This book focussing on the following topics: Nanocomposites preparation and characterization of metal oxide nanocomposites; synthesis of core/shell metal oxide nanocomposites; multilayer thin films; sequential assembly of nanocomposite materials; semiconducting polymer metal oxide nanocomposites; graphene-based metal and metal oxide nanocomposites; carbon nanotube–metal–oxide nanocomposites; silicon mixed oxide nanocomposites; gas semiconducting sensors based on metal oxide nanocomposites; metal-organic framework nanocomposite for hydrogen production and nanocomposites application towards photovoltaic and photocatalytic.

In today's nanotechnology and pharmaceutical research, alternative toxicology testing methods are crucial for ethically and commercially sound practice. This book provides practical guidelines on how to develop and validate quantitative nanostructure-toxicity relationship (QNTR) models, which are ideal for rapidly exploring the effects of a large number of variables in complex scenarios. Through contributions by academic, industrial, and governmental experts, *Modelling the Toxicity of Nanoparticles* delivers clear instruction on these methods and their integration and use in risk assessment. Specific topics include the physico-chemical characteristics of engineered nanoparticles, nanoparticle interactions, in vivo nanoparticle processing, and more. A much-needed practical guide, *Modelling the Toxicity of Nanoparticles* is a key text for researchers as well as government and industry regulators.

Nanocomposites present outstanding mechanical properties and compatibility owing to their composite matrix and unique physical and chemical composition provided by large surface-area-to-

volume ratios and high interfacial reactivity. Freedom to functionalize nanocomposites with various chemical groups increases their affinity toward target pollutants, which is highly desirable for the selective extraction of target analytes in complex environmental matrixes. This book presents the recent progress in the field of nanocomposites and their properties, fabrication methods, and applications for pollution control and sensing. It discusses the advances in pollution control techniques made possible because of nanocomposites and focuses on environment-friendly and efficient approaches. The text also covers economic, toxicological, and regulatory issues and research trends.

Ceramic nanocomposites have been found to have improved hardness, strength, toughness and creep resistance compared to conventional ceramic matrix composites. Ceramic nanocomposites reviews the structure and properties of these nanocomposites as well as manufacturing and applications. Part one looks at the properties of different ceramic nanocomposites, including thermal shock resistance, flame retardancy, magnetic and optical properties as well as failure mechanisms. Part two deals with the different types of ceramic nanocomposites, including the use of ceramic particles in metal matrix composites, carbon nanotube-reinforced glass-ceramic matrix composites, high temperature superconducting ceramic nanocomposites and ceramic particle nanofluids. Part three details the processing of nanocomposites, including the mechanochemical synthesis of metallic–ceramic composite powders, sintering of ultrafine and nanosized ceramic and metallic particles and the surface treatment of carbon nanotubes using plasma technology. Part four explores the applications of ceramic nanocomposites in such areas as energy production and the biomedical field. With its distinguished editors and international team of expert contributors, Ceramic nanocomposites is a technical guide for professionals requiring knowledge of ceramic nanocomposites, and will also offer a deeper understanding of the subject for researchers and engineers within any field dealing with these materials. Reviews the structure and properties of ceramic nanocomposites as well as their manufacturing and applications Examines properties of different ceramic nanocomposites, as well as failure mechanisms Details the processing of nanocomposites and explores the applications of ceramic nanocomposites in areas such as energy production and the biomedical field

This Special Issue deals with the fascinating material class of nanocomposites consisting of extremely small particles (nanoparticles) which are embedded in polymers. Such materials are of paramount interest in various disciplines, especially chemistry, physics, biomedicine and materials science. Due to the diversity of the components of nanocomposites, they provide a broad spectrum of material properties and applications. The versatility of nanocomposites is indeed reflected by the research covered in this Special Issue. The field of nanocomposites includes innovative science and a source of inspiration for currently relevant economic topics as well as for envisaged technologies of the future. Indeed, this volume alludes to strategies for the preparation of nanocomposites and possibilities for a variety of applications, such as catalytic reactions, gas barriers, high refractive index materials, corrosion protection, electromagnetic interference (EMI) shielding, lithium ion batteries, tissue engineering and plastic surgery.

This book presents emerging economical and environmentally friendly polymer composites that are free of the side effects observed in traditional composites. It focuses on eco-friendly composite materials using granulated cork, a by-product of the cork industry; cellulose pulp from the recycling of paper residues; hemp fibers; and a range of other environmentally friendly materials procured from various sources. The book presents the manufacturing methods, properties and characterization techniques of these eco-friendly composites. The respective chapters address classical and recent aspects of eco-friendly polymer composites and their chemistry, along with practical applications in the biomedical, pharmaceutical, automotive and other sectors. Topics addressed include the fundamentals, processing, properties, practicality, drawbacks and advantages of eco-friendly polymer composites. Featuring contributions by experts in the field with a variety of backgrounds and specialties, the book will appeal to researchers and students in the fields of materials science and environmental science. Moreover, it fills the gap between research work in the laboratory and practical applications in related industries.

The field of polymer nanocomposites has become essential for engineering and military industries over the last few decades as it applies to computing, sensors, biomedical microelectronics, hard coating, and many other domains. Due to their outstanding mechanical and thermal features, polymer nanocomposite materials have recently been developed and now have a wide range of applications. Polymer Nanocomposites for Advanced Engineering and Military Applications provides emerging research on recent advances in the fabrication methods, properties, and applications of various nano-fillers including surface-modification methods and chemical functionalization. Featuring coverage on a broad range of topics such as barrier properties, biomedical microelectronics, and matrix processing, this book is ideally designed for engineers, industrialists, chemists, government officials, military professionals, practitioners, academicians, researchers, and students.

Biocomposites, formed by a matrix and a reinforcement of natural fibers, often mimic the structure of living materials and offer the strength of the matrix as well as biocompatibility. Being renewable, cheap, recyclable, and biodegradable, they have witnessed rapidly growing interest in terms of industrial and fundamental applications. This book focuses on fiber-based composites applied to biomedical and environmental applications. It presents a comprehensive survey of biocomposites from the existing literature, paying particular attention to various biomedical and environmental applications. The text describes mechanical designs and manufacturing aspects of various fibrous polymer matrix composites and presents examples of the synthesis and development of bionanocomposites and their applications. The book is the first of its kind to present all these topics together unlike most other books on nano-/biocomposites that are generally limited to their fundamentals, different methods of synthesis, and applications.

Glass Nanocomposites: Synthesis, Properties and Applications provides the latest information on a rapidly growing field of specialized materials, bringing light to new research findings that include a growing number of technologies and applications. With this growth, a new need for deep understanding of the synthesis methods, composite structure, processing and application of glass nanocomposites has emerged. In the book, world renowned experts in the field, Professors Karmakar, Rademann, and Stepanov, fill the knowledge gap, building a bridge between the areas of nanoscience, photonics, and glass technology. The book covers the fundamentals, synthesis, processing, material properties, structure property correlation, interpretation thereof, characterization, and a wide range of applications of glass nanocomposites in many different devices and branches of technology. Recent developments and future directions of all types of glass nanocomposites, such as metal-glasses (e.g., metal nanowire composites, nanoglass-mesoporous silica composites), semiconductor-glass and ceramic-glass nanocomposites, as well

as oxide and non-oxide glasses, are also covered in great depth. Each chapter is logically structured in order to increase coherence, with each including question sets as exercises for a deeper understanding of the text. Provides comprehensive and up-to-date knowledge and literature review for both the oxide and non-oxide glass nanocomposites (i.e., practically all types of glass nanocomposites) Reviews a wide range of synthesis types, properties, characterization, and applications of diverse types of glass nanocomposites Presents future directions of glass nanocomposites for researchers and engineers, as well as question sets for use in university courses

The two volumes of Handbook of Gas Sensor Materials provide a detailed and comprehensive account of materials for gas sensors, including the properties and relative advantages of various materials. Since these sensors can be applied for the automation of myriad industrial processes, as well as for everyday monitoring of such activities as public safety, engine performance, medical therapeutics, and in many other situations, this handbook is of great value. Gas sensor designers will find a treasure trove of material in these two books.

The production of 'polymer nanocomposites' has recently gained considerable attention from both the academic and industrial community, especially in the area of nanoscience. This is mainly due to their enhanced improvements in physico-mechanical, thermal and barrier properties compared to micro and more conventional composites. Their nanoscale dimensions, biodegradable character, cost-effectiveness and sustainability have constituted a stimulus for this increasing interest. Currently there is no limit to the possibility of applications. However, despite all this progress, it is still difficult to achieve uniform dispersion between the filler and the matrix, as agglomerations form far too easily and the production of polymer nanocomposites with high mechanical and thermal properties is still limited. The authors of this proposed book, are of the opinion, that with the increase in scientific publications and the rapid progress in processing possibilities to produce nanocomposites based on various nanoscale fillers (silica/clay), a book that collects all of these scientific findings in one place would be timely and of great interest to both students and scientific researchers, who are concerned with the production, and application of nanocomposites as new innovative materials. The authors aim is to present the latest research findings on the fabrication, properties and applications of nanofillers as reinforcement in polymer nanocomposites. Particular emphasis will be placed on the introduction of various nanofillers (silica/clay) into different elastomeric polymer matrices that will enhance the properties of these materials and their applications. The book will provide an up-to-date review of major innovations in the field and act as a reference for future research in materials science and engineering, which is highly topical due to the demand to produce more sustainable and eco-friendly innovative advanced materials from elastomeric polymers. Emphasis on silica/clay as outstanding reinforcing potential in elastomeric polymer matrices Up-to-date on the most relevant innovations in the field of silica/clay nanocomposites and their extensive applications in advanced material science Establishes the most suitable fabrication methods, properties and applications as a solid foundation in materials science and engineering disciplines Includes the incorporation of dual nanofillers that significantly improve the properties of nanocomposites

Nanocellulose, a unique and promising natural material extracted from native cellulose, has received immense interest for its broad spectrum of applications owing to its remarkable physical properties, special surface chemistry, and excellent biological properties (biocompatibility, biodegradability and low toxicity). In attempts to meet the requirements of humanity's well-being, biomaterials scientists taking advantage of the structure and properties of nanocellulose aim to develop new and formerly non-existing materials with novel and multifunctional properties. This book highlights the importance of nanocellulose and reviews its synthesis, types, structure and properties. Further, it discusses various biofabrication approaches and applications of nanocellulose-based biomaterials in various fields such as the environment, biomedicine, optoelectronics, pharmaceuticals, paper, renewable energy and the food industry. Devised to have a broad appeal, this book will be useful to beginners, who will appreciate its comprehensive approach, as well as active researchers, who will find the focus on recent advancements highly valuable.

This second edition of Nanocrystalline Materials provides updated information on the development and experimental work on the synthesis, properties, and applications of nanocrystalline materials. Nanocrystalline materials with new functionalities show great promise for use in industrial applications — such as reinforcing fillers in novel polymer composites — and substantial progress has been made in the past decade in their synthesis and processing. This book focuses primarily on 1D semiconducting oxides and carbon nanotubes, 2D graphene sheets and 0D nanoparticles (metals and inorganic semiconductors). These materials are synthesized under different compositions, shapes and structures, exhibiting different chemical, physical and mechanical properties from their bulk counterparts. This second edition presents new topics relevant to the fast-paced development of nanoscience and nanotechnology, including the synthesis and application of nanomaterials for drug delivery, energy, printed flash memory, and luminescent materials. With contributions from leading experts, this book describes the fundamental theories and concepts that illustrate the complexity of developing novel nanocrystalline materials, and reviews current knowledge in the synthesis, microstructural characterization, physical and mechanical behavior, and application of nanomaterials. Investigates the synthesis, characterization, and properties of a large variety of nanocrystalline materials, and their applications in industry Keeps the prominent challenges in nanomaterials fabrication at the forefront while offering the most up-to-date scientific findings Written by experts in nanomaterials with academic backgrounds in chemistry, physics, and materials engineering

Advances in Polymer Science enjoys a longstanding tradition and good reputation in its community. Each volume is dedicated to a current topic, and each review critically surveys one aspect of that topic, to place it within the context of the volume. The volumes typically summarize the significant developments of the last 5 to 10 years and discuss them critically, presenting selected examples, explaining and illustrating the important principles, and bringing together many important references of primary literature. On that basis, future research directions in the area can be discussed. Advances in Polymer Science volumes thus are important references for every polymer scientist, as well as for

other scientists interested in polymer science - as an introduction to a neighboring field, or as a compilation of detailed information for the specialist.

Polysaccharide-Based Nanocomposites for Gene Delivery and Tissue Engineering presents quantitative background on new polysaccharide nanocomposites in a clear and logical way, highlighting the most exciting applications in gene delivery and tissue engineering and their progress. The book focuses on the different types of polysaccharide nanocomposites for gene delivery and tissue engineering and covers polysaccharide hydrogels for tissue engineering and polysaccharide magnetic nanocomposites for gene delivery. Chapters cover various nanocomposites presented in twenty-one separate chapters. This book will be of great interest to all those researching the development and applications of polysaccharide-based nanocomposites for modeling. As polysaccharide-based nanocomposites promise cutting-edge applications in gene delivery and tissue engineering, with their development at the forefront of modern medicine, this book is a welcome title on this exciting science. Presents quantitative background on new polysaccharide nanocomposites for advanced medicine Focuses on polysaccharide nanocomposites in relation to gene delivery and tissue engineering Highlights the most exciting, leading-edge applications in gene delivery and tissue engineering Covers polysaccharide hydrogels for tissue engineering and magnetic nanocomposites for gene delivery Offers a logical and useful presentation of polysaccharide nanocomposites organized first by application and then by nanocomposite

Advanced bionanocomposite materials continue to be increasingly popular and are important for a wide range of scientific and engineering applications. In the race to exploit the unique mechanical, thermal, and electrical properties of bionanocomposite materials, researchers need to address new challenges in predicting, understanding, and managing the potentially adverse effects these materials could have on the environment and human life. This book focuses on the fundamentals of bionanostructured materials and bionanocomposites. It deals with some recent developments in the synthesis and characterization of bionanomaterials as well as their incorporation into polymer matrixes. The biological applications of bionanomaterials are also discussed in detail, along with the synthesis of bionanostructured materials and bionanocomposites, reviews of food packing, water remediation, heavy metal ion adsorption from wastewaters, and other industrial applications. This book is aimed at beginners in this field as well as advanced undergraduate- and graduate-level students of materials science and researchers working in the fields of bionanocomposites, nanotechnology, and analytical chemistry, especially those with an interest in materials for analytical applications.

Polymer Nanocomposites Containing Graphene: Preparation, Properties and Applications provides detailed up-to-date information on the characterization, synthesis, processing, properties and application of these materials. Key topics that are covered in the book include: the methods of synthesis and preparation of graphene as well as different processes and methods of functionalization and modification of graphene for improving composite properties. The preparation techniques focus on which method is advantageous for getting improvements in properties along with their drawbacks. The structure and property relationships are also discussed in detail. The issues related to graphene dispersion in polymer matrices is also addressed as well as the use of graphene as reinforcement in thermoset resins. The different properties of the composites like mechanical, electrical, dielectric, thermal, rheological, morphology, spectroscopy, electronic, optical, and toxicity are reviewed from the geometrical and functional point of view. Applications cover electrical and electronic fields, flame and fire retardancy, structural, sensing and catalysis, membrane, in fuel cell and solar energy, hydrogen production, aerospace engineering, packaging, and biomedical/bioengineering fields. Up-to-date patents on graphene-polymer nanocomposites are also covered. Those working in graphene-based materials will benefit from the detailed knowledge presented in this book on graphene synthesis, composite preparation methods, and the related problems associated with them. The book will enable researchers to select the appropriate composite as per their respective field of application. Presents novel approaches for the preparation of graphene, its modification and nanocomposites with enhanced properties for state-of-the-art applications Special attention is given to how graphene is synthesized through different routes, their functionality, dispersion related matters and structural aspects controlling the composite properties for various applications All synthesis methodology and functionalization procedure for graphene is discussed

Smart Polymer Nanocomposites: Biomedical and Environmental Applications presents the latest information on smart polymers and their promising application in various fields, including their role in delivery systems for drugs, tissue engineering scaffolds, cell culture sports, bioseparation, and sensors or actuator systems. Features detailed information on the preparation, characterization and applications of smart functional polymer composites Covers a broad range of applications in both the biomedical and environmental engineering fields Chapters are written by authors with diverse background expertise from the faculties of chemistry, engineering and the manufacturing industry

This book summarizes recent advances in the fabrication methods, properties, and applications of various ceramic-filled polymer matrix composites. Surface-modification methods and chemical functionalization of the ceramic fillers are explored in detail, and the outstanding thermal and mechanical properties of polymer-ceramic composites, the modeling of some of their thermal and mechanical parameters, and their major potential applications are discussed along with detailed examples. Aimed at researchers, industry professionals, and advanced students working in materials science and engineering, this work offering a review of a vast number of references in the polymer-ceramic field, this work helps readers easily advance their research and understanding of the field.

This book examines the application of nanoscience and nanotechnology in military defence strategies. Both historical and current perspectives on military technologies are discussed. The book provides comprehensive details on current trends in the application of nanotechnology to ground, air, and naval specializations. Furthermore, nanotechnology-enabled high energy explosives and propellants, chemical, biological, radiation, and nuclear threats and their detection/protection, and camouflage and stealth for signature management of military targets in multispectral wavelength signals are analyzed. The book also covers nanotechnology-enabled armor and platforms, which may serve as lightweight and high mechanical strength options in contrast to conventional systems. Finally, the book also emphasizes future military applications of nanotechnology and its integration into 'smart' materials. Provides comprehensive details on trends in the application of nanotechnology to ground, air, and naval

defence systems; Examines the application of nanoscience and nanotechnology in military defence strategies; Offers pathways and research avenues for development of nanotechnology and materials applications in military capacities.

Composites are materials made from two or more constituent materials with significantly different physical or chemical properties. The two materials combine together to give a new material with higher strength, toughness, stiffness, but also a higher resistance to creep, corrosion, wear or fatigue compared to conventional materials. It is composed primarily of a matrix i.e. a continuous phase which is armoured with secondary discontinues reinforcement phase. These materials have been used in a variety of products viz. spacecrafts, sporting goods, catalyst, sensors, actuators, biomedical materials, batteries, cars, furniture, aircraft components, etc. This book focusses on processing, properties of various types of composite materials, as well as their environmental engineering applications. This book examines the current state of art, new challenges, and opportunities of composites in environmental engineering. The chapters in this book covers nearly every topic related to composites in environmental engineering in four broad perspectives: (i) classification of composites (ii) green/hybrid synthesis and characterization of nano and biocomposites (iii) processing of composite materials (iv) state-of-the-art in fabricating the composites - nano and biocomposites - for environmental applications.

Environmental Applications of Carbon Nanomaterials-Based Devices Explore this insightful treatment of the function and fabrication of high-performance devices for environmental applications Environmental Applications of Carbon Nanomaterials-Based Devices delivers an overview of state-of-the-art technology in functionalized carbon nanomaterials-based devices for environmental applications. The book provides a powerful foundation, based in materials science, on functionalized carbon nanomaterials in general, and environmental science and device fabrication in particular. The book focuses on the chemical and physical methods of functionalization of carbon nanomaterials and the technology of device fabrication, including lab-on-a-chip approaches and applications such as wastewater purification and gas sensing. It provides readers with a thorough understanding of effective environmental remediation techniques performed with carbon nanomaterials-based devices. In addition to topics such as cross-linked graphene oxide membranes assembled with graphene oxide nanosheets, free-standing graphene oxide-chitin nanocrystal composite membranes for dye adsorption and oil/water separation, and in-situ grown covalent organic framework nanosheets on graphene for membrane-based dye/salt separation, readers will also benefit from the inclusion of: A thorough introduction to charge-gated ion transport through polyelectrolyte intercalated amine reduced graphene oxide membranes An exploration of hydrotalcite/graphene oxide hybrid nanosheets functionalized nanofiltration membrane for desalination A discussion of the incorporation of attapulgite nanorods into graphene oxide nanofiltration membranes for efficient dyes wastewater treatment An examination of attapulgite nanofibers and graphene oxide composite membranes for high-performance molecular separation Perfect for materials scientists, analytical chemists, and environmental chemists, Environmental Applications of Carbon Nanomaterials-Based Devices will also earn a place in the libraries of sensor developers seeking a one-stop resource for high-performance devices and sensors useful for environmental applications.

The addition of nanoparticles to polymer composites has led to a new generation of composite materials with enhanced and novel properties. Advances in polymer nanocomposites reviews the main types of polymer nanocomposites and their applications. Part one reviews types of polymer nanocomposites according to fillers. Processing of carbon nanotube-based nanocomposites, layered double hydroxides (LDHs) and cellulose nanoparticles as functional fillers and reinforcement are discussed, alongside calcium carbonate and metal-polymer nanocomposites. Part two focuses on types of polymer nanocomposites according to matrix polymer, with polyolefin-based, (PVC)-based, nylon-based, (PET)-based and thermoplastic polyurethane (TPU)-based polymer nanocomposites discussed. Soft, gel and biodegradable polymer nanocomposites are also considered. Part three goes on to investigate key applications, including fuel cells, aerospace applications, optical applications, coatings and flame-retardant polymer nanocomposites. With its distinguished editor and international team of expert contributors, Advances in polymer nanocomposites is an essential guide for professionals and academics involved in all aspects of the design, development and application of polymer nanocomposites. Reviews the main types of polymer nanocomposites and their applications Discusses processing of carbon nanotube-based nanocomposites, layered double hydroxides (LDHs) and cellulose nanoparticles as functional fillers and reinforcement Discusses polyolefin-based, (PVC)-based, nylon-based, (PET)-based and thermoplastic polyurethane (TPU)-based polymer nanocomposites

This book is a comprehensive introduction to "green" or environmentally friendly polymer composites developed using renewable polymers of natural origin such as starch, lignin, cellulose acetate, poly-lactic acid (PLA), polyhydroxylalkanoates (PHA), polyhydroxybutyrate (PHB), etc., and the development of modern technologies for preparing green composites with various applications. The book also discusses major applications of green polymer composites in industries such as medicine, biotechnology, fine chemicals and engineering.

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