

Nanoclays Synthesis Characterization And Applications

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Green Composites for Automotive Applications presents cutting-edge, comprehensive reviews on the industrial applications of green composites. The book provides an elaborative assessment of both academic and industrial research on eco-design, durability issues, environmental performance, and future trends. Particular emphasis is placed on the processing and characterization of green composites, specific types of materials, such as thermoset and thermoplastic, nanocomposites, sandwich, and polymer biofoams. Additional sections cover lifecycle and risk analysis. As such, this book is an essential reference resource for R&D specialists working in materials science, automotive, chemical, and environmental engineering, as well as R&D managers in industry. Contains contributions from leading experts in the field Covers experimental, analytical and numerical analysis Deals with most important automotive aspects Provides a special section dedicated to lifecycle assessment

Handbook of Thermoset Plastics, Fourth Edition provides complete coverage of the chemical processes, manufacturing techniques and design properties of each polymer, along with its applications. This new edition has been expanded to include the latest developments in the field, with new chapters on radiation curing, biological adhesives, vitrimers, and 3D printing. This detailed handbook considers the practical implications of using thermoset plastics and the relationships between processing, properties and applications, as well as analyzing the strengths and weakness of different methods and applications. The aim of the book is to help the reader to make the right decision and take the correct action on the basis of informed analysis – avoiding the pitfalls the authors' experience has uncovered. In industry, the book supports engineers, scientists, manufacturers and R&D professionals working with plastics. The information included will also be of interest to researchers and advanced students in plastics engineering, polymer chemistry, adhesives and coatings. Offers a systematic approach, guiding the reader through chemistry, processing methods, properties and applications of thermosetting polymers Includes thorough updates that discuss current practice and the new developments on biopolymers, nanotechnology, 3D printing, radiation curing and biological adhesives Uses case studies to demonstrate how particular properties make different polymers suitable for different applications Covers end-use and safety considerations

This book deals with one of the most attractive fields in material science and technology research. In fact, the concept of organic–inorganic hybrid materials is applied to a wide variety of approaches that include materials with inorganic and/or organic nature with respect to their matrices and/or dispersed phase. The present book compiles one editorial and eleven approaches to the topic, and intends to provide a transversal idea about what the field of the so-called organic–inorganic hybrid materials means in actual scientific scenarios. In any case, the role is pointed out of the interphase between the components as the critical aspect to consider, as a way to enhance and understand these components in order to design materials with "tailor-made" organized structures considering the increasing nano-, meso-, micro- and macro-scales.

This book provides the most recent understanding about climate change and its effects on agriculture in India. Further in-depth research is showcased regarding important allied sectors such as horticulture and fisheries, and examines the effect of climate change on different cereal crops. The individual chapters discuss the different mitigation strategies for climate change impacts and detail abiotic and biotic stresses in relation to climate change. The book provides an insight into environmentally safe and modern technologies approaches such as nanotechnology and utilization of underutilized crops under a changing climate. This book provides a solid foundation for the discussion of climate resilience in agricultural systems and the requirements to keep improving agricultural production. This book is an excellent resource for researchers, instructors, students in agriculture, horticulture and environmental science.

This book highlights the most essential advances in nanoclay-based nanocomposites, especially natural fibre-reinforced polymer composites. Readers will find extensive information on nanoclay from preparation to applications, and the characterization techniques needed in order to evaluate the resulting properties of nanoclay-based natural fibre-reinforced polymer composites. Topics covered include the characterization of nano-sized clay, chemical modification, and processing techniques for nanocomposites from nanoclay. The book offers a valuable reference guide for academics and industrial practitioners alike.

NANOCLAYSSynthesis, Characterization and ApplicationsClay NanoparticlesProperties and ApplicationsElsevier

Micro and Nano Fibrillar Composites (MFCs and NFCs) from Polymer Blends is a comprehensive reference for researchers, students and scientists working in the field of plastics recycling and composites. The book aims to determine the influence of micro and nanofibrillar morphology on the properties of immiscible blend systems. Chapters cover micro and nanofibrillar composites based on polyolefin, liquid crystal polymer, biodegradable polymers, polyester and polyamide blends in various industrial application fields. The book brings together panels of highly-accomplished experts in the field of plastics recycling, blends and composites systems. For several decades, plastic technology has played an important role in many industrial applications, such as packaging, automobiles, aerospace and construction. However the increasing use of plastics creates a lot of waste. This has led to restrictions on the use of some plastics for certain applications and a drive towards recycling of plastics. More recently, microfibrillar in-situ composites have been prepared from waste plastics such as PET/PP, PET/PE and Nylon/PP as a way of formulating new high performance polymer systems. This book tackles these issues and more, and is an ideal resource for anyone interested in polymer blends. Provides information on MFC and NFC based polymer blends that have been accumulated over the last 25 years, providing a useful reference Adopts a novel approach in terms of understanding the relationship between processing, morphology, structure, properties and applications in micro and nanofibrillar composites Contains contributions from leading experts in the field from both industrial and academic research

In recent times, polymer nanocomposites have attracted a great deal of scientific interest due to their unique advantages over conventional plastic materials, such as superior strength, modulus, thermal stability, thermal and electrical conductivity, and gas barrier. They are finding real and fast-growing applications in wide-ranging fields such as automotive, aerospace, electronics, packaging, and sports. This book focuses on the development of polymer nanocomposites as an advanced material for textile applications, such as fibers, coatings, and nanofibers. It compiles and details cutting-edge research in the science and nanotechnology of textiles with special reference to polymer nanocomposites in the form of invited chapters from scientists and subject experts from various institutes from all over the world. They include authors who are actively involved in the research and development of polymer nanocomposites with a wide range of functions—including antimicrobial, flame-retardant, gas barrier, shape memory,

sensor, and energy-scavenging—as well as medical applications, such as tissue engineering and wound dressings, to create a new range of smart and intelligent textiles. Edited by Mangala Joshi, a prominent nanotechnology researcher at the premier Indian Institute of Technology, Delhi, India, this book will appeal to anyone involved in nanotechnology, nanocomposites, advanced materials, polymers, fibers and textiles, and technical textiles.

Nanotechnology progresses its concerts and suitability by improving its effectiveness, security and also reducing the impact and risk. Various chapters in this book are written by eminent scientists and prominent researchers in the field of nanotechnology across the world. This book is focused to put emerging techniques forward using nanoparticles for safe and nutritional food production, protecting crops from pests, increasing nutritional value and providing solutions for various environmental issues. The outcome of this book creates a path for wide usage of nanoparticles in food, agriculture and the environment fields. This book has clear and simple illustrations, tables and case studies to understand the content even by non-experts. This book especially deals with the nanotechnology for controlling plant pathogens, food packaging and preservation, agricultural productivity, waste water treatment and bioenergy production. Hence, this book can be adopted and used by many researchers and academicians in the fields of food, agriculture, environment and nanotechnology for catering the needs of sustainable future. The salient features of this book are • Describes nanotechnology as an interdisciplinary and emerging field in life sciences • Useful for researchers in the cutting edge life science related fields of nanoscience, nanobiology and nanotechnology • Deal with various problems in food, agriculture and environmental sector for sustainable solutions through the application of nanotechnology • Supported with illustrations in color, tables and case studies (wherever applicable), and • Contributed and well written by nanotechnology experts from across various disciplines

Green Synthesis, Characterization and Applications of Nanoparticles shows how eco-friendly nanoparticles are engineered and used. In particular, metal nanoparticles, metal oxide nanoparticles and other categories of nanoparticles are discussed. The book outlines a range of methodologies and explores the appropriate use of each. Characterization methods include spectroscopic, microscopic and diffraction methods, but magnetic resonance methods are also included as they can be used to understand the mechanism of nanoparticle synthesis using organisms. Applications covered include targeted drug delivery, water purification and hydrogen generation. This is an important research resource for those wishing to learn more about how eco-efficient nanoparticles can best be used. Theoretical details and mathematical derivations are kept to a necessary minimum to suit the need of interdisciplinary audiences and those who may be relatively new to the field. Explores recent trends in growth, characterization, properties and applications of nanoparticles Gives readers an understanding on how they are applied through the use of case studies and examples Assesses the advantages and disadvantages of a variety of synthesis and characterization techniques for green nanoparticles in different situations

This second edition of the successful reference work has been updated and revised with approximately 30% new content to reflect the numerous instrumental developments and improvements, as well as the significant expansion of this rapidly developing field. For example, the combination of IR imaging with AFM has enhanced the achievable lateral resolution by an order of magnitude down to a few hundred nanometers, thus launching a multiplicity of new applications in material science. Furthermore, Raman and IR spectroscopic imaging have become key technologies for the life sciences and today contribute tremendously to a better and more detailed understanding of numerous biological and medical research topics. The topical structure of this new edition is now subdivided into four parts. The first treats the fundamentals of the instrumentation for infrared and Raman imaging and mapping and an overview on the chemometric tools for image analysis. The second part describes a wide variety of applications ranging from biomedical via food, agriculture and plants to polymers and pharmaceuticals. This is followed by a description of imaging techniques operating beyond the diffraction limit, while the final part covers special methodical developments and their utility in specific fields. With its many valuable practical tips, this is a must-have overview for researchers in academic and industrial laboratories wishing to obtain reliable results with this method.

This book delves into the field of immobilizing biologically active and non-active molecules. It discusses the designing strategy of immobilization and the current state-of-the-art applications for advancing biomedical, agricultural, environmental and industrial practices. It focuses on aspects ranging from fundamental principles to current technological advances at multi-scale levels (macro, micro, and nano) which are suitable for cell, enzyme, and nano-catalyst based applications. Written by experts from across the globe, the contents deal with illustrated examples of molecular and cellular interactions with materials/scaffolds and discussions on factors that can affect the functionality and yield of the process. With its discussions on material science, design of delivery vehicles, separation science, additive manufacturing, agriculture and environmental science, this book will be a useful reference for researchers across multiple disciplines.

Clay–Polymer Nanocomposites is a complete summary of the existing knowledge on this topic, from the basic concepts of synthesis and design to their applications in timely topics such as high-performance composites, environment, and energy issues. This book covers many aspects of synthesis such as in-situ polymerization within the interlamellar spacing of the clays or by reaction of pristine or pre-modified clays with reactive polymers and prepolymers. Indeed, nanocomposites can be prepared at industrial scale by melt mixing. Regardless the synthesis method, much is said in this book about the importance of the clay pre-modification step, which is demonstrated to be effective, on many occasions, in obtaining exfoliated nanocomposites. Clay–Polymer Nanocomposites reports the background to numerous characterization methods including solid state NMR, neutron scattering, diffraction and vibrational techniques as well as surface analytical methods, namely XPS, inverse gas chromatography and nitrogen adsorption to probe surface composition, wetting and textural/structural properties. Although not described in dedicated chapters, numerous X-ray diffraction patterns of clay–polymer nanocomposites and reference materials are displayed to account for the effects of intercalation and exfoliations of layered aluminosilicates. Finally, multiscale molecular simulation protocols are presenting for predicting morphologies and properties of nanostructured polymer systems with industrial relevance. As far as applications are concerned, Clay–Polymer Nanocomposites examines structural composites such as clay–epoxy and clay–biopolymers, the use of clay–polymer nanocomposites as reactive nanocomposite fillers, catalytic clay-(conductive) polymers and similar nanocomposites for the uptake of hazardous compounds or for controlled drug release, antibacterial applications, energy storage, and more. The most comprehensive coverage of the state of the art in clay–polymer nanocomposites, from synthesis and design to opportunities and applications Covers the various methods of characterization of clay–polymer nanocomposites - including spectroscopy, thermal analyses, and X-ray diffraction Includes a discussion of a range of application areas, including biomedicine, energy storage, biofouling resistance, and more

Understand the principles, applications, and limitations of a cutting-edge material Based on the author's 26 years of experience in the field of Nanotechnology, this reference offers researchers and materials scientists a complete reference to the physical concepts, techniques, applications and principles underlying one of the most researched materials. Keeps you abreast of the latest trends, developments, and commercial applications

Silicon-Based Hybrid Nanoparticles: Fundamentals, Properties, and Applications focuses on the fundamental principles and promising applications of silicon-based hybrid nanoparticles in nanoelectronics, energy storage/conversion, catalysis, sensors, biomedicine, environment and imaging. This book is an important reference source for materials scientists and engineers who are seeking to understand more about the major properties and applications of silicon-based hybrid nanoparticles. As the hybridization of silicon nanoparticles with other semiconductors or metal oxides nanoparticles may exhibit superior

features, when compared to lone, individual nanoparticles, this book provides the latest insights. In addition, the silicon/iron oxide hybrid nanoparticles also possess excellent fluorescence, super-paramagnetism, and biocompatibility that can be effectively used for the diagnostic imaging system in vivo. Similarly, gold-silicon nanohybrids could be used as highly efficient near-infrared hyperthermia agents for cancer cell destruction. Outlines the major thermal, electrical, optical, magnetic and toxic properties of silicon-based hybrid nanoparticles Describes major applications in energy, environmental science and catalysis Assesses the major challenges to manufacturing silicon-based nanostructured materials on an industrial scale

Clay Nanoparticles: Properties and Applications sets out the major properties of clay nanoparticles and their technological applications. The first part of the book focuses on the characterization of nanoclays, including layered, fibrous and tubular clay minerals. The second part illustrates the current and potential applications of nanoclays within material science and biotechnology. These include the development of geopolymers and bionanocomposites based on sustainable polymers filled with eco-compatible nanoclay. The potential use of nanoclays as flame retardants is also discussed, along with the correlation between the properties and potential applications of several nanoclay types. In particular, the applications explored include nanoclays as drug delivery systems and for environmental protection. The book provides a complete and multidisciplinary exploration of nanoclays, highlighting a range of perspectives within current nanotechnology research. Assesses the advantages of using nanoclays instead of conventional clay materials in product design Describes the major characterization techniques – both experimental and computational – for nanoclays Explores new fabrication techniques based on pristine and modified clay nanoparticles that are being used both in materials science and biotechnology

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This volume chronicles the proceedings of the Third International Symposium on Polyimides and Other High Temperature Polymers: Synthesis, Characterization, and Applications, held in Orlando, December 17-19, 2003. This volume is divided into three parts. Part 1. "Synthesis, Properties and Bulk Characterization"; Part 2 "Hybrids and Composites" and Part 3 "Applications and General Papers". The topics covered include: Synthesis, characterization and processing (including some novel approaches) of a variety of polyimides and other high temperature polymers; structure-property relationships; hybrids and nanocomposites using these materials and their characterization, properties and applications; segmental dynamics in polyimide materials; photoalignable polyimides; photoconductivity and photosensitivity of polyimides; ultrafiltration membranes from polyetherimide; polyimide as a tunneling barrier; polymer materials for nonlinear optical applications; alignment of SWNTs in rigid-rod polymer compositions; surface modification of polyimide; adhesion of Cu to polyimide surfaces; and polyimide erosion in a low Earth orbit space environment.

This classic reference examines the mechanisms driving adhesion, categories of adhesives, techniques for bond formation and evaluation, and major industrial applications. Integrating recent innovation and improved instrumentation, the work offers broad and comprehensive coverage. This edition incorporates several new adhesive classes, new application topics, and recent developments with nanoadhesives and bio-based adhesives. Existing chapters are thoroughly updated, revised, or replaced and authored by top specialists in the field. Abundant figures, tables, and equations appear throughout the work.

Polyhedral Oligomeric Silsesquioxane (POSS) Polymer Nanocomposites: From Synthesis to Applications offers extensive coverage of polyhedral oligomeric silsesquioxanes and their nanocomposites, including their synthesis, characterization, interfacial interactions and advanced applications. Sections introduce essentials, information on their preparation and discussions on polymeric materials, including elastomers, thermoplastics, thermosetting polymers, polymer blends and IPNs. Further sections cover the latest analysis techniques, examine the properties of POSS-polymer nanocomposites, and discuss key application areas, such as biological, energy, defense, and space. Finally, issues surrounding industry implementation and lifecycle are explored. This is a valuable reference for researchers, scientists and advanced students in the areas of polymer composites and nanocomposites, polymer chemistry, polymer physics, polymer science, and materials science and engineering. In an industrial setting, this book will be of great interest to scientists, R&D professionals, and engineers across industries and disciplines. Covers all aspects of polyhedral oligomeric silsesquioxanes (POSS) and their nanocomposites, including synthesis and characterization techniques, properties, analysis, applications and trends Targets POSS nanocomposites, describing synthesis, characterization and the selection of POSS filler types according to polymeric material Explains the preparation and utilization of POSS polymer nanocomposites for cutting-edge applications, including biological, energy, and defense field applications

This book demonstrates the beneficiation of Indian bentonites for the synthesis of nanoclays and its application for polymer nanocomposites, rheological modifier, metal nanoparticles support and adsorbent. The book is divided into seven chapters. The first chapter deals with introduction of nanoclays and its applications in various fields with thorough review of the literature. The second chapter discusses the beneficiation of Indian bentonites by sedimentation and chemical treatments. The optimum conditions for the purification of bentonite using this technique are developed. The third chapter illustrates the synthesis of nanoclays by ion exchange reaction of montmorillonite and various quaternary ammonium or phosphonium salts. In the fourth chapter, the detailed studies on the reinforcement effect of nanoclays in polypropylene for the synthesis of polypropylene/nanoclay nanocomposites are elaborated. The fifth chapter consists of the application of the nanoclays as supporting materials for metal nanoparticles. The palladium, rhodium, gold and silver metal nanoparticles anchored on nanoclays are synthesized. The application of nanoclays for removal of organic contaminants in batch and dynamic conditions from wastewater are studied in the sixth chapter. The final chapter summarizes the major findings and future direction for nanoclays.

Heterostructured nanoparticles have the capability for a broad range of novel and enhanced properties, which leads to appealing biomedical and environmental applications. This timely new book addresses the design and preparation of multiphase nanomaterials with desired size, shape, phase composition, and crystallinity, as well as their current applications. It emphasizes key examples to motivate deeper studies, including nanomaterial-based hyperthermia treatment of cancer, nanohybrids for water purification, nanostructures used in the removal or detection of bioagents from waste water, and so on.

Features Presents state of the art research on heterostructured nanomaterials, from their synthesis and physiochemical properties to current environmental and biological applications. Includes details on toxicity and risk assessment of multifunctional nanomaterials. Discusses recent developments and utilization in healthcare by leading experts. Introduces the main features of functionalization of nanomaterials in terms of desired size, shape, phase composition, surface functionalization/coating, toxicity, and geometry. Emphasizes practical applications in the environmental and biomedical sectors.

A polymer containing small amounts of ionic groups either along the polymer backbone chains or as pendant groups is defined as ionomer. As originally proposed by Eisenberg, the interaction between ionic groups leads to the formation of multiplets containing a small number of ion pairs, and also to ionic clusters, which constitute a second phase made of many multiplets as well as portions of the hydrocarbon chains. These ionic structures have been shown to act as strong electrostatic cross-links, which provide altered physical properties, such as enhanced mechanical properties and high melt viscosity, among

others. Both aromatic polyesters as aliphatic are polymeric materials widely used today. Their most familiar applications are in clothing, food packaging and water and carbonated soft drinks bottles. Major part of biodegradable synthetic polymers are polyesters, and in particular, aliphatic polyesters. Monomers for the latter can be synthesized from renewable resources. Biodegradable polyesters play a key role in medical applications due to their biodegradability and versatile synthesis able to afford tailored properties; they are currently employed as biomaterials for medical purposes such as surgical sutures, scaffolds, screws and reinforcing plates as well as controlled release drug carriers, since they are biocompatible and nontoxic. This thesis is focused to the chemical modification of aromatic and aliphatic polyesters through the incorporation of various concentration and different ionic groups. We synthesized poly(hexamethylene terephthalate) and poly(butylene succinate)-based ionomers and investigated the effects of the ionic substitution on physical properties, crystallization rates and hydrodegradability of these polyester ionomers. In addition, we also studied the influence of the ionic interaction with nanoclays in the formation of ionomers-based nanocomposites. This thesis embodies a multidisciplinary task work that includes synthesis, spectroscopy characterization, evaluation of thermal and mechanical properties, hydrolytic degradation and nanocomposites preparation: the synthesis procedure of copolyesters was made in all cases by polycondensation in melt-phase. Different conditions of temperature, catalyst and time required were used for each family of copolyesters depending on both the stability and the reactivity of the comonomers involved in the synthesis. The copolyesters synthesized incorporated sulfonated, ammonium, trimethylammonium and tributylphosphonium ionic groups into their chains. The hydrolytic degradation results suggest that the insertion of sulfonated groups in the copolyesters make them more hydrophilic allowing better solvation and an easier attack of water on the ester groups. Nanocomposites with nanoclays were obtained by using different approaches for mixing and in some cases by making use of compatibilizers. Octadecyltrimethylammonium, 1,12-dodecylendiammonium salts and a terpolyester ionomer were used for compatibilization. The clay was used either unmodified or modified with alkylammonium soaps. Results obtained by the different procedures were compared and the effect of the compatibilizers on the mixing efficiency and composite properties were evaluated. Characterization was carried out by ¹H and ¹³C nuclear magnetic resonance (NMR) spectroscopy, FTIR spectroscopy, gel permeation chromatography (GPC), differential scanning calorimetry (DSC), and thermogravimetry analysis (TGA). The changes in crystal structure upon copolymerization were followed by X-ray diffraction (XRD).

This book is part of a two-volume book series that exhaustively reviews the key recent research into nanoclay reinforced polymer composites. This second volume focuses on nanoclay based nanocomposites and bionanocomposites fabrication, characterization and applications. This includes classification of nanoclay, chemical modification and processing techniques of nanocomposites. The book also provides comprehensive information about nanoclay modification and functionalization; modification of nanoclay systems, geological and mineralogical research on clays suitability; bio-nanocomposites based on nanoclays; modelling of mechanical behaviour of halloysite based composites; mechanical and thermal properties of halloysite nanocomposites; the effect of Nanoclays on gas barrier properties of polymers and modified nanocomposites. This book is a valuable reference guide for academics and industrial practitioners alike.

This book examines carbon-based nanocomposite materials and their application in various environmental fields, such as wastewater treatment, and air and soil remediation. Featuring illustrations, and tables summarizing the latest research, it gathers up-to-date information on the application of carbon nanocomposites in the removal of environmental pollutants from different sources. Given its scope, the book is a valuable textbook for research students, and a useful handbook and reference resource for researchers, academics and industrial scientists working in the field of environmental pollutants and their safe removal.

Emerging innovations in the medical sector have created new opportunities for improved patient care and disease control. By optimizing current practices and procedures, improvements in healthcare delivery and quality can be achieved. Oral Healthcare and Technologies: Breakthroughs in Research and Practice is a comprehensive resource with the latest scholarly perspectives on the technological advancements and real-world applications for oral hygiene and medical care. Featuring extensive coverage across a range of relevant perspectives and topics, such as disease management, healthcare administration, and medical informatics, this multi-volume book is ideally designed for professionals, researchers, students, and practitioners seeking academic material on developments and innovations in oral medicine.

There is a major lack of fundamental knowledge and understanding on the interaction between a filler and the polymer matrix. When it comes to nanoscale fillers, such as layered silicates, carbon nanotubes, graphene or cellulose nanofibers it is even more important to know accurate structure-property relationships as well as identifying the parameters influencing material behavior. The reason for the lack of knowledge on how to process nanocomposites and why there are so few applications is that several scientific fields are affected and a joint effort of those scientific communities involved is necessary – starting from the filler manufacturing or pre-processing over polymer chemistry to the polymer processing. In Polymer Nanoclay Composites, all involved scientific areas are viewed together for the first time, providing an all-embracing coverage of all stages of polymer clay nanocomposites processing from lab-scale to industrial scale – stages from the raw material over manufacturing of polymer clay nanocomposites to characterization and the final products. Readers will gain insight in the physical/chemical pre-processing of layered silicates and their incorporation into a polymer matrix using sophisticated technologies (such as advanced compounding) as well as in real-time quality control of the nanocomposite production and future prospects. The book also describes nanotoxicological and nanosafety aspects. Covers the whole processing route with all aspects of the nanocomposites industry with particular focus on the processing of polymer clay nanocomposites Includes quality control and nanosafety Multidisciplinary approach from an industrial perspective

An overview of the current state of nanotechnology-based devices with applications in environmental science, focusing on nanomaterials and polymer nanocomposites. The handbook pays special attention to those nanotechnology-based approaches that promise easier, faster and cheaper processes in environmental monitoring and remediation. Furthermore, it presents up-to-date information on the economics, toxicity and regulations related to nanotechnology in detail. The book closes with a look at the role of nanotechnology for a green and sustainable future. With its coverage of existing and soon-to-be-realized devices this is an indispensable reference for both academic and corporate R&D.

This book highlights the various types of polymer and nanocomposites that can be derived from biorenewable resources. It covers various aspects of biobased polymers and nanocomposites, including preparation, processing, properties, and performance, and the latest advances in these materials. It also includes recent findings from leading researchers in academia and industry, government, and private research laboratories around the globe, providing the latest information on biobased polymers and nanocomposites. Offering an overview of the entire production process, it guides readers through all stages, from the raw source materials, processing and property characterization to application performance. This book is suitable for professionals and researchers seeking in-depth practical information as well as the fundamental science behind this. It also serves as a point of reference for undergraduate and graduate students, as well as postdoctoral researchers working in the area of polymer and composites with a special emphasis on biobased materials.

Polymer-Based Nanocomposites for Energy and Environmental Applications provides a comprehensive and updated review of major innovations in the field of polymer-based nanocomposites for energy and environmental applications. It covers properties and applications, including the synthesis of polymer based nanocomposites from different sources and tactics on the efficacy and major challenges associated

with successful scale-up fabrication. The chapters provide cutting-edge, up-to-date research findings on the use of polymer based nanocomposites in energy and environmental applications, while also detailing how to achieve material's characteristics and significant enhancements in physical, chemical, mechanical and thermal properties. It is an essential reference for future research in polymer based nanocomposites as topics such as sustainable, recyclable and eco-friendly methods for highly innovative and applied materials are current topics of importance. Covers a wide range of research on polymer based nanocomposites Provides updates on the most relevant polymer based nanocomposites and their prodigious potential in the fields of energy and the environment Demonstrates systematic approaches and investigations from the design, synthesis, characterization and applications of polymer based nanocomposites Presents a useful reference and technical guide for university academics and postgraduate students (Masters and Ph.D.)

Contamination of aqueous environments by hazardous chemical compounds is the direct cause of the decline of safe clean water supply throughout the globe. The use of unconventional water sources such as treated wastewater will be a new norm. Emerging nanotechnological innovations have great potential for wastewater remediation processes. Applications that use smart nanomaterials of inorganic and organic origin improve treatment efficiency and lower energy requirements. This book describes the synthesis, fabrication, and application of advanced nanomaterials in water treatment processes; their adsorption, transformation into low toxic forms, or degradation phenomena, and the adsorption and separation of hazardous dyes, organic pollutants, heavy metals and metalloids from aqueous solutions. It explains the use of different categories of nanomaterials for various pollutants and enhances understanding of nanotechnology-based water remediation to make it less toxic and reusable.

Discusses polymer nanocomposites composed of a family of polymeric materials whose properties are capable of being tailored to meet specific applications.

Biorenewable polymers based nanomaterials are rapidly emerging as one of the most fascinating materials for multifunctional applications. Among biorenewable polymers, cellulose based nanomaterials are of great importance due to their inherent advantages such as environmental friendliness, biodegradability, biocompatibility, easy processing and cost effectiveness, to name a few. They may be produced from biological systems such as plants or be chemically synthesised from biological materials. This book summarizes the recent remarkable achievements witnessed in green technology of cellulose based nanomaterials in different fields ranging from biomedical to automotive. This book also discusses the extensive research developments for next generation nanocellulose-based polymer nanocomposites. The book contains seventeen chapters and each chapter addresses some specific issues related to nanocellulose and also demonstrates the real potentialities of these nanomaterials in different domains. The key features of the book are: Synthesis and chemistry of nanocellulose from different biorenewable resources Different characterization of nanocellulosic materials and their respective polymer nanocomposites Physico-chemical, thermal and mechanical investigation of nanocellulose based polymer nanocomposites Provides elementary information and rich understanding of the present state-of- art of nanocellulose-based materials Explores the full range of applications of different nanocellulose-based materials.

Covering a broad range of polymer science topics, Handbook of Polymer Synthesis, Characterization, and Processing provides polymer industry professionals and researchers in polymer science and technology with a single, comprehensive handbook summarizing all aspects involved in the polymer production chain. The handbook focuses on industrially important polymers, analytical techniques, and formulation methods, with chapters covering step-growth, radical, and co-polymerization, crosslinking and grafting, reaction engineering, advanced technology applications, including conjugated, dendritic, and nanomaterial polymers and emulsions, and characterization methods, including spectroscopy, light scattering, and microscopy.

Original monograph discusses graphene within the carbon chemistry alternatives available to materials engineers and explains how it is incorporated into polymer-matrix, as well as ceramic- and metal-matrix composite materials. The book shows how different forms of graphene can be synthesized and then added to polymer composites as main or hybrid nanofillers, with a focus on how graphene affects electrical and mechanical properties. Offers the theory and data necessary to design novel graphene-based composites with unique load-bearing, flammability and wear properties. Throughout, the book lists many newly discovered mechanical, thermal and electrical properties of graphene. Emerging uses of graphene in films, coatings and colloidal suspensions (i.e., graphene with liquid matrices) are also investigated.

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Fundamentals of Nanoparticles: Classifications, Synthesis Methods, Properties and Characterization explores the nanoparticles and architecture of nanostructured materials being used today in a comprehensive, detailed manner. This book focuses primarily on the characterization, properties and synthesis of nanoscale materials, and is divided into three major parts. This is a valuable reference for materials scientists, and chemical and mechanical engineers working in R&D and academia, who want to learn more about how nanoparticles and nanomaterials are characterized and engineered. Part one covers nanoparticles formation, self-assembly in the architecture nanostructures, types and classifications of nanoparticles, and signature physical and chemical properties, toxicity and regulations. Part two presents different ways to form nanometer particles, including bottom-up and top-down approaches, the classical and non-classical theories of nanoparticles formation and self-assembly, surface functionalization and other surface treatments to allow practical use. Part three covers characterization of nanoparticles and nanostructured materials, including the determination of size and shape, in addition to atomic and electronic structures and other important properties. Includes new physical and chemical techniques for the synthesis of nanoparticles and architecture nanostructures Features an in-depth treatment of nanoparticles and nanostructures, including their characterization and chemical and physical properties Explores the unusual properties of materials that are developed by modifying their shape and composition and by manipulating the arrangement of atoms and molecules Explains important techniques for the synthesis, fabrication and the characterization of complex nano-architectures

This book is mostly based on papers presented at the Fourth International Symposium on this topic held in Savannah, Georgia. However, in addition to these papers, certain very relevant papers have also been included to broaden the scope and thus enhance the value of this book. Currently there is tremendous interest in these material because of their unique properties and applications in diverse technological areas ranging from microelectronics to aerospace to adhesive bonding. This book is divided into three parts: Part 1: Synthesis and Bulk Characterization; Part 2: Surface and Interface Aspects (Composites and Metallization); and Part 3: Applications. The topics covered include: synthesis of a number of polyimides with tailored properties; nanocomposites for high-performance applications; molecular assembly of polyimides; polyimide L-B films; metallization of polyimides; applications of high temperature polymers as proton exchange membranes; dielectrics, and in textile.

State-of-the-art overview on bioepoxy polymers as well as their blends and composites -- covering all aspects from fundamentals to applications! Bioepoxy polymers is an emerging area and have attracted more and more attention due to their biodegradability and good thermo-mechanical performance. In recent years, research progress has been made in synthesis, processing, characterization, and applications of bioepoxy blends and composites. Bioepoxy polymers are very promising candidates to replace the traditional thermosetting nonbiodegradable polymers. Bio-Based Epoxy Polymers, Blends and Composites summaries recent research progress on bioepoxy polymers as well as their blends and composites. It covers aspects from synthesis, processing, various characterization techniques to broad spectrum of applications. It provides a correlation of physical properties with macro, micro and nanostructures of the materials. Moreover, research trends, future directions, and opportunities are also discussed. Attracts attention: Bioepoxy polymers are environmentally friendly and considered as a promising candidate to replace the traditional thermosetting nonbiodegradable polymers Highly application-oriented: Bioepoxy polymers can be used in a broad range of applications such as polymer foams, construction, aerospace, automobiles, self-healing systems One-stop reference: Covers all aspects of bioepoxy polymer, their blends and composites, such as synthesis, properties, processing, characterization and applications Broad audience: Attracts attention from both academia and industry

The application of nanotechnology within the medical sphere has had a significant influence on how diseases and conditions are treated and diagnosed. While many strides have been made, there is still continuous research on nanotechnology being performed in the field. Advancing Medicine through Nanotechnology and Nanomechanics Applications highlights emergent trends and empirical research on technological innovations in medicine and healthcare. Investigating the impact of nanotechnology and nanomechanics on the treatment of diseases, regenerative medicine, and drug delivery systems, this publication is a vital reference source for professionals, researchers, medical students, and engineering students.

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