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Graphene-Based Polymer Nanocomposites

Models and Applications

 Springer

Graphene Based Polymer Nanocomposites In Electronics Springer Series On Polymer And Composite Materials

Niranjan Karak



Graphene Based Polymer Nanocomposites In Electronics Springer Series On Polymer And Composite Materials:

Graphene-Based Polymer Nanocomposites in Electronics Kishor Kumar Sadasivuni, Deepalekshmi Ponnammam, Jaehwan Kim, Sabu Thomas, 2015-01-19 This book covers graphene reinforced polymers which are useful in electronic applications including electrically conductive thermoplastics composites thermosets and elastomers It systematically introduces the reader to fundamental aspects and leads over to actual applications such as sensor fabrication electromagnetic interference shielding optoelectronics superconductivity or memory chips The book also describes dielectric and thermal behaviour of graphene polymer composites properties which are essential to consider for the fabrication and production of these new electronic materials The contributions in this book critically discuss the actual questions in the development and applications of graphene polymer composites It will thus appeal to chemists physicists materials scientists as well as nano technologists who are interested in the properties of graphene polymer composites Bio-based Polymers and Nanocomposites

Muhammed Lamin Sanyang, Mohammad Jawaid, 2019-02-05 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 **Carbon-Containing Polymer Composites**

Mostafizur Rahaman, Dipak Khastgir, Ali Kanakhir Aldalbahi, 2018-10-05 This book discusses the methods synthesizing various carbon materials like graphite carbon blacks carbon fibers carbon nanotubes and graphene It also details different functionalization and modification processes used to improve the properties of these materials and composites From a geometrical structural point of view it examines different properties of the composites such as mechanical electrical dielectric thermal rheological morphological spectroscopic electronic optical and toxic and describes the effects of carbon types and their geometrical structure on the properties and applications of composites *Multi Frequency EPR Spectroscopy of Conjugated Polymers and Their Nanocomposites*

Victor I. Krinichnyi, 2016-10-14 Conjugated polymeric materials and their nanocomposites are widely used for the creation of alternative sources of renewable energy cell phone screens mobile gadgets video players and OLED TV as well as organic diodes transistors sensors etc with field dependent and spin assisted electronic properties Multifrequency EPR Spectroscopy methods can help researchers optimize their structural magnetic and electronic properties for the creation

of more efficient molecular devices This book will acquaint the reader with the basic properties of conjugated polymers the fundamentals of EPR Spectroscopy and the information that can be obtained at different wavebands of EPR spectroscopy

Nanomaterials and Polymer Nanocomposites Niranjana Karak, 2018-10-24 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

Graphene to Polymer/Graphene Nanocomposites Ayesha Kausar, 2021-09-23 Graphene to Polymer Graphene Nanocomposites Emerging Research and Opportunities brings together the latest advances and cutting edge methods in polymer graphene nanocomposites that offer attractive properties and features leading to a broad range of valuable applications The initial chapters of this book explain preparation properties modification and applications of graphene and graphene based multifunctional polymeric nanocomposites Later the state of the art potential of polymer graphene nanocomposites for hierarchical nanofoams graphene quantum dots graphene nanoplatelets graphene nanoribbons etc has been elucidated The subsequent chapters focus on specific innovations and applications including stimuli responsive graphene based materials anticorrosive coatings applications in electronics and energy devices gas separation and filtration membrane applications aerospace applications and biomedical applications Throughout the book challenges and future opportunities in the field of polymer graphene nanocomposites are discussed and analyzed This is an important resource for researchers scientists and students academics working with graphene and across the fields of polymer composites nanomaterials polymer science chemistry chemical engineering biomedical engineering materials science and engineering as well those in an industrial setting who are interested in graphene or innovative materials Explores the fundamentals preparation properties processing and applications of graphene and multifunctional polymer graphene nanocomposites Focuses on the state of the art including topics such as nano foam architectures graphene quantum dots graphene

nanoplatelets graphene nanoribbons and other graphene nanostructures Provides advanced applications including shape memory materials anticorrosion materials electronics and energy devices gas separation and filtration membranes aerospace relevance and biomedical applications *Polymer and Ceramic Composite Materials* Nouredine Ramdani,2019-02-07 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 **Polymer Nanocomposites Containing Graphene** Mostafizur Rahaman,Lalatendu

Nayak,Ibnelwaleed A. Hussein,Narayan Chandra Das,2021-08-22 *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 **Functional**

Nanostructured Interfaces for Environmental and Biomedical Applications Valentina Dinca,Mirela Sucnea,2019-05-17 *Functional Nanostructured Interfaces for Environmental and Biomedical Applications* provides an overview on the

characteristics of nanostructured interfaces and their processing technologies for a wide range of applications in the sensing photocatalytic and bioengineering areas The book focuses on the fundamentals of multifunctional nanostructured interfaces and their associated technologies including versatile technologies such as colloidal lithography scanning probe techniques and laser nanostructuring which can be used to obtain multifunctional 2D and 3D nanotextured interfaces The book provides multidisciplinary chapters summarizes the current status of the field and covers important scientific and technological developments made over past decades As such it is an invaluable reference to those working in the design of novel nanostructured materials Covers emerging applications of nanostructured interfaces with a focus on sensing bio related and environmental applications Provides detailed and up to date overviews on the characteristics of nanostructured interfaces and their processing technologies including materials from multifunctional graphene to extremophile materials Includes information about versatile technologies such as colloidal lithography scanning probe techniques and laser nanostructuring all of which can all be used to obtain multifunctional 2D and 3D nanotextured interfaces

Advances in Metal Oxides and Their Composites for Emerging Applications Sagar D. Delekar, 2022-08-26 Advances in Metal Oxides and their Composites for Emerging Applications reviews key properties of metal oxide based composites including their structural physicochemical optical electrical components and resulting performance in a wide range of diverse applications Synthetic protocols used to create metal oxides with desirable morphologies properties and performance for applications in solar energy harvesting energy storage and environmental remediation are emphasized Emerging technologies that address important global challenges such as energy shortage the hazardous effects of non renewable energy sources unaffordable energy technologies and the contaminants present in air and water are also covered This book is an ideal resource for materials scientists and engineers working in academia and R D In addition it s appropriate for those who either need an introduction to potential research directions or for experienced researchers and practitioners looking for a key reference on the latest advances Introduces the fundamental properties of metal oxide based composites paying special attention to physicochemical optical electrical and structural characteristics Provides an overview of the synthetic protocols used to design and tune the properties of metal oxide based composites for key emerging applications Discusses metal oxide based composites and their use in energy applications such as energy storage energy harvesting and environmental remediation

Biopolymer Composites in Electronics Kishor Kumar Sadasivuni, John-John Cabibihan, Deepalekshmi Ponnammam, Mariam AlAli AlMaadeed, Jaehwan Kim, 2016-09-10 Biopolymer Composites in Electronics examines the current state of the art in the electronic application based on biopolymer composites Covering the synthesis dispersion of fillers characterization and fabrication of the composite materials the book will help materials scientists and engineers address the challenges posed by the increased use of biopolymeric materials in electronic applications The influence of preparation techniques on the generation of micro meso and nanoscale fillers and the effect of filler size and dispersion on various biopolymers are

discussed in detail Applications covered include sensors actuators optics fuel cells photovoltaics dielectrics electromagnetic shielding piezoelectrics flexible displays and microwave absorbers In addition characterization techniques are discussed and compared enabling scientists and engineers to make the correct choice of technique This book is a one stop reference for researchers covering the entire state of the art in biopolymer electronics Written by a collection of expert worldwide contributors from industry academia government and private research institutions it is an outstanding reference for researchers in the field of biopolymer composites for advanced technologies Enables researchers to keep up with the rapid development of biopolymer electronics which offer light flexible and more cost effective alternatives to conventional materials of solar cells light emitting diodes and transistors Includes thorough coverage of the physics and chemistry behind biopolymer composites helping readers to become rapidly acquainted with the field Provides in depth information on the range of biopolymer applications in electronics from printed flexible conductors and novel semiconductor components to intelligent labels large area displays and solar panels

Conducting Polymers for Advanced Energy Applications Ram K. Gupta, 2021-12-22 This book details the use of conducting polymers and their composites in supercapacitors batteries photovoltaics and fuel cells nearly covering the entire spectrum of energy area under one title Conducting Polymers for Advanced Energy Applications covers a range of advanced materials based on conducting polymers the fundamentals and the chemistry behind these materials for energy applications FEATURES Covers materials chemistry various synthesis approaches and the properties of conducting polymers and their composites Discusses commercialization and markets and elaborates on advanced applications Presents an overview and the advantages of using conducting polymers and their composites for advanced energy applications Describes a variety of nanocomposites including metal oxides chalcogenides graphene and materials beyond graphene Offers the fundamentals of electrochemical behavior This book provides a new direction for scientists researchers and students in materials science and polymer chemistry who seek to better understand the chemistry behind conducting polymers and improve their performance for use in advanced energy applications

Nanoparticle-Based Polymer Composites Sanjay Mavinkere Rangappa, Jyotishkumar Parameswaranpillai, Yashas Gowda T G, Suchart Siengchin, M. Ozgur Seydibeyoglu, 2022-07-15 Nanoparticle Based Polymer Composites discusses recent advancements on the synthesis processing characterization and applications of this new class of hybrid materials Chapters cover recycling and lifecycle assessment with contributions from leading researchers in industry academics the government and private research institutes from across the globe As nanoparticle based polymer composites are now replacing traditional polymer composites in a broad range of applications such as fuel cells electronic and biomedical devices this book presents the latest advancements in the field Studies have shown that incorporating metal nanoparticles in polymer matrices can improve their mechanical thermal electrical and barrier properties The unique combination of these properties makes this new class of materials suitable for a broad range of different and advanced applications Features recent advancements

on the synthesis processing and characterization of nanoparticle based polymer composites Discusses recycling and lifecycle assessment Highly application orientated with contributions from leading international researchers in industry academia the government and private research institutes

Elastomer-Based Composite Materials Nikolay Dishovsky, Mihail Mihaylov, 2018-05-15 Elastomer Based Composite Materials Mechanical Dynamic and Microwave Properties and Engineering Applications is focused on elastomer based composite materials comprising different types of reinforcing fillers The book provides an informative examination of the possibilities for broadening the engineering applications of elastomer composites through using various types of hybrid fillers ferrites and ceramics and also examines their synthesis and characterization It discusses new hybrid fillers that have been synthesized by different techniques e g impregnation of different substrates carbon black conductive carbon black activated carbons etc with silica or magnetite These new fillers have been thoroughly characterized by standard techniques and by up to date methods such as energy dispersive X ray spectroscopy in scanning transmission electron microscopy STEM EDX atomic absorption spectroscopy AAS and inductively coupled plasma optical emission spectroscopy ICP OES The effect of those fillers upon the curing properties mechanical and dynamic parameters electrical conductivity and dielectric and microwave characteristics of elastomer based composites is discussed in detail in this volume The book also covers the influence of various types of ceramics SiC B4C and TiB2 and barium and strontium hexaferrites upon the aforementioned properties of rubber composites in conjunction with a view toward solutions for environmental problems caused by waste tires The book shows that pyrolysis cum water vapor is a suitable and environmentally friendly method for the conversion of the waste green tires into useful carbon silica hybrid fillers The properties of elastomer based composites comprising different types of nanostructures fullerenes carbon nanotubes graphene nanoplatelets modified activated carbons and calcined kaolin are also discussed Special attention is paid to composites with lower levels of zinc oxide The volume provides an abundance of knowledge on the detailed characterization of these fillers and on the curing mechanical dynamic mechanical and dielectric and microwave properties of the elastomeric composites The book surveys the most recent research activities of the authors which will make it a vital reference source for scientists in both the academic and industrial sectors as well as for individuals who are interested in rubber materials It will be very useful for students especially PhD students scientists lecturers and engineers working or doing research in the field of polymer materials science elastomer based composites and nanocomposites and their engineering applications in the production of microwave absorbers and electromagnetic waves shielding materials materials for electronics devices and telecommunications

Polymer Nanocomposites based on Inorganic and Organic Nanomaterials Smita Mohanty, Sanjay K. Nayak, B. S. Kaith, Susheel Kalia, 2015-06-17 This book covers all aspects of the different classes of nanomaterials from synthesis to application It investigates in detail the use and feasibility of developing nanocomposites with these nanomaterials as reinforcements The book encompasses synthesis and properties of cellulose nanofibers bacterial

nanocellulose carbon nanotubes nanofibers graphene nanodiamonds nanoclays inorganic nanomaterials and their nanocomposites for high end applications such as electronic devices energy storage structural and packaging The book also provides insight into various modification techniques for improving the functionality of nanomaterials apart from their compatibility with the base matrix *Biopolymer-Based Films and Coatings* Sneh Punia Bangar, Anil Kumar

Siroha, 2023-05-30 With the growing concern for the environment and the rising price of crude oil there is increasing demand for non petroleum based polymers from renewable resources Biopolymer films have been regarded as potential replacements for synthetic films in food packaging due to a strong marketing trend toward environmentally friendly materials Biopolymer based films and coatings display good barrier properties flexibility transparency economic profitability and environmental compatibility Therefore they have successfully been used for packaging various food products Biopolymer Based Films and Coatings Trends and Challenges elaborates on the recent methods and ingredients for making biodegradable films and coatings as well as the current requirements for food security and environmental issues This book also explores films and coatings prepared with essential oils antimicrobial substances and bioactive components that make up this active packaging Films and coating chapters are based on biopolymers used to prepare films and coatings that is carbohydrates lipids proteins and so on This book provides a platform for researchers and industrialists on the basic and advanced concepts of films and coatings Key Features Provides a comprehensive analysis of recent findings on biopolymers carbohydrate protein and lipid based films and coatings Contains a wealth of new information on the properties functionality and applications of films and coatings Presents possible active and functional components and ingredients for developing films and coatings Guides start up researchers on where to start the latest research work in packaging It has been estimated that the global production of bioplastics is set to hike from 2.11 in 2020 to 2.87 million tonnes in 2025 Further the demand for fresh ready to eat or semi finished foods is increasing and the need to maintain food safety and quality further exacerbates the challenges in the supply chain especially with the globalization of food trade and the use of centralized processing facilities for food distribution It is an urgent requirement to increase shelf life and reduce food product loss Considering the great market demand for biodegradable material based packaging systems this book comes at an opportune time to enable researchers and food scientists to develop suitable solutions considering the sustainability and economic feasibility of the process **Polymer**

Nanocomposite Coatings Vikas Mittal, 2016-04-19 This work explores the use of composite nanotechnology for thin coatings on various substrates It compiles recent advances in nanocomposite coatings for experienced researchers and provides background information for those new to the field The book not only explains the synthesis of bulk nanocomposite materials it describes their application in *Design and Applications of Nanostructured Polymer Blends and Nanocomposite Systems* Sabu Thomas, Robert Shanks, Sarath Chandran, 2015-09-22 Design and Applications of Nanostructured Polymer Blend and Nanocomposite Systems offers readers an intelligent thorough introduction to the design and applications of this

new generation of designer polymers with customized properties The book assembles and covers in a unified way the state of the art developments of this less explored type of material With a focus on nanostructured polymer blends the book discusses the science of nanostructure formation and the potential performance benefits of nanostructured polymer blends and composites for applications across many sectors electronics coatings adhesives energy photovoltaics aerospace automotive and medical devices biocompatible polymers The book also describes the design morphology and structure of nanostructured polymer composites and blends to achieve specific properties Covers all important information for designing and selecting the right nanostructured polymer system Provides specialized knowledge on self repairing nanofibre and nanostructured multiphase materials as well as evaluation and testing of nanostructured polymer systems Serves as a reference guide for development of new products in industries ranging from electronics coatings and energy to transport and medical applications Describes the design morphology and structure of nanostructured polymer composites and blends to achieve specific properties

Composite Materials for Industry, Electronics, and the Environment Omari V.

Mukbaniani, Devrim Balköse, Heru Susanto, A. K. Haghi, 2019-06-03 This new volume focuses on different aspects of composite systems that are associated with research and development helping to bridge the gap between classical analysis and modern real life applications The chapters look at the experimental and theoretical aspects of composite materials regarding preparation processing design properties and practical implications It also presents recent advancements research and development prospects of advanced composite materials that provide new solutions for advanced technologies

Biocarbon Polymer Composites Deepa Kodali, Vijaya Rangari, 2023-12-15 This book explores cutting edge biocarbon polymer composites The book brings together nine edited chapters that explore the development properties and applications of these eco friendly materials highlighting their potential to transform industries and reduce the environmental impact of traditional polymers Spanning a range of critical topics this book begins with an introduction to biocarbon and polymer materials providing a solid foundation It then progresses into the latest research on biocarbon sources processing techniques and characterization methods Subsequent chapters cover the mechanical thermal and electrical properties of biocarbon polymer composites along with their applications in diverse industries such as automotive construction and packaging Contributors highlight real world case studies and examples to showcase the practical relevance of these materials Readers will gain a comprehensive understanding of the science and technology behind biocarbon polymer composites enabling them to make informed decisions in materials selection and development In an era of increasing environmental consciousness this book emphasizes the eco friendly nature of biocarbon composites offering sustainable alternatives to traditional plastics Additionally this book bridges the information gaps between different disciplines and it is intended for a wide range of readers from materials scientists and engineers to environmentalists and industry policymakers Readership Researchers and scientists in materials science and engineering Professionals in industries seeking sustainable alternatives to traditional

plastics Environmentalists and policymakers interested in promoting eco friendly materials Academics and students studying materials science polymer chemistry and sustainable technologies Innovators and entrepreneurs looking to capitalize on emerging materials trends

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Introduction

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