Aerogels Handbook

This book provides a detailed description of metal-complex functionalized carbon allotrope forms, including classic (such as graphite), rare (such as M- or T-carbon), and nanoforms (such as carbon nanotubes, nanodiamonds, etc.). Filling a void in the nanotechnology literature, the book presents chapters generalizing the synthesis, structure, properties, and applications of all known carbon allotropes. Metal-complex composites of carbons are described, along with several examples of their preparation and characterization, soluble metal-complex carbon composites, cost-benefit data, metal complexes as precursors of carbon allotropes, and applications. A lab manual on the synthesis and characterization of carbon allotropes and their metal-complex composites is included. Provides a complete description of all carbon allotropes, both classic and rare, as well as carbon nanostructures and their metal-complex composites; Contains a laboratory manual of experiments on the synthesis and characterization of metal-complex carbon composites; Discusses applications in diverse fields, such as catalysis on supporting materials, water treatment, sensors, drug delivery, and devices.

This comprehensive three-volume handbook brings together a review of the current state together with the latest developments in sol-gel technology to put forward new ideas. The first volume, dedicated to synthesis and shaping, gives an in-depth overview of the wet-chemical processes that constitute the core of the sol-gel method and presents the various pathways for the successful synthesis of inorganic and hybrid organic-inorganic materials, bio- and bio-inspired materials, powders, particles and fibers as well as sol-gel derived thin films, coatings and surfaces. The second volume deals with the mechanical, optical, electrical and magnetic properties of sol-gel derived materials and the methods for their characterization such as diffraction methods and nuclear magnetic resonance, infrared and Raman spectroscopies. The third volume concentrates on the various applications in the fields of membrane science, catalysis, energy research, biomaterials science, biomedicine, photonics and electronics.

This book presents an exhaustive overview of electrochemical sensors and biosensors for the analysis and monitoring of the most important analytes in the environmental field, in industry, in treatment plants and in environmental research. The chapters give the reader a comprehensive, state-of-the-art picture of the field of electrochemical sensors suitable to environmental analytes, from the theoretical principles of their design to their implementation, realization and application. The first three chapters discuss fundamentals, and the last three chapters cover the main groups of environmental interest.

A collection of 15 papers from The American Ceramic Society's 38th International Conference on Advanced Ceramics and Composites, held in Daytona Beach, Florida, January 26-31, 2014. This issue includes papers presented in Symposium 5 - NextGeneration Bioceramics and Biocomposites and Symposium 9 - PorousCeramics: Novel Developments and Applications.

Lignin in Polymer Composites presents the latest information on lignin, a natural polymer derived from renewable resources that has great potential as a reinforcement material in composites because it is non-toxic, inexpensive, available in large amounts, and is starting to be deployed in various materials applications due to its advantages over more traditional oil-based materials. This book reviews the state-of-the-art on the topic and their applications to composites, including thermoplastic, thermosets, rubber, foams, bioplastics, nanocomposites, and lignin-based carbon fiber composites. In addition, the book covers critical assessments on the economics of lignin, including a cost-performance analysis that discusses its strengths and weaknesses as a reinforcement material. Finally, the huge potential applications of lignin in industry are explored with respect to its low cost, recyclable properties, and fully biodegradable composites, and the way they apply to the automotive, construction, and packaging industries. Reviews the state-of-the-art on the topic and their applications to composites, including thermoplastic, thermosets, rubber, foams, bioplastics, nanocomposites, and lignin-based carbon fiber composites Presents the essential processing and properties information for engineers and materials scientists, enabling the use of lignin in composites Provides critical insight into the applications and future trends of lignin-based composites, including advantages, shortcomings, and economics Includes a thorough coverage of extraction, modification, processing, and applications of the material.

This conference book contains papers presented at the 8th GACM Colloquium on Computational Mechanics for Young Scientists from Academia and Industry. The conference was held from August 28th – 30th, 2019 in Kassel, hosted by the Institute of Mechanics and Dynamics of the department for civil and environmental engineering and by the chair of Engineering Mechanics / Continuum Mechanics of the department for mechanical engineering of the University of Kassel. The aim of the conference is, to bring together young scientists who are engaged in academic and industrial research on Computational Mechanics and Computer Methods in Applied Sciences. It provides a platform to present and discuss recent results from research efforts and industrial applications. In more than 150 presentations, given by young scientists, current scientific developments and advances in engineering practice in this field are presented and discussed. The contributions of the young researchers are supplemented by a poster session and plenary talks from four senior scientists from academia and industry as well as from the GACM Best PhD Award winners 2017 and 2018.

The recast of the Energy Performance of Buildings Directive (EPBD) was adopted by the European Parliament and the Council of the European Union on 19 May 2010. For new buildings, the recast fixes 2020 as the deadline for all new buildings to be “nearly zero energy” (and even sooner for public buildings – by the end of 2018). This book gives practitioner an important tool to tackle the challenges of building refurbishment towards nearly zero energy. This book is welcome at this time and sets the scene for professionals whether practitioners or researchers to learn more about how we can make whether old or new buildings more efficient and effective in terms of energy performance. Because of unique water properties, humidity affects materials and many living organisms, including humans. Humidity control is important in various fields, from production management to creating a comfortable living environment. The range of materials that can be used in the development of humidity sensors is very broad, and the third volume of the Handbook of Humidity Measurement offers an analysis on various humidity-sensitive materials and sensor technologies used in the fabrication of humidity sensors and methods acceptable for their testing. Additional features include: numerous strategies for the fabrication and characterization of humidity-sensitive materials and sensing structures used in sensor applications, methods and properties to develop smaller, cheaper, more robust, and accurate devices with better sensitivity and stability, a guide to sensor selection and an overview of the humidity sensor market, and new technology solutions for integration, miniaturization, and specificity of the humidity sensor calibration. Handbook of Humidity Measurement, Volume 3: Sensing Materials and Technologies provides valuable information for practicing engineers, measurement experts, laboratory technicians, project managers in industries and national laboratories, and university students and professors interested in solutions to humidity measurement tasks. Despite the fact that this book is devoted to the humidity sensors, it can be used as a basis for understanding fundamentals of any gas sensor operation and development.

New smart materials are developing thanks to nanotechnology. Many books are on the market, but the demand for specialized analyses of particular topics still remains. This multi-author book focuses on the application of nanotechnology to cement-based materials for engineering applications. The addition of novel smart nanofillers allows the development of multifunctional composite materials and not just with respect to higher mechanical strength, as investigated in the past. Special attention is given to types of nanoenclosures, novel techniques to mix components, and analysis of properties that can be achieved by paste, mortar, or concrete if they are added with nanofillers. Among these properties, the capability of self-sensing is very promising. Moreover, the use of phase-changing materials improves energy efficiency of nanocomposites, with important applications in the field of engineering, and new nanomodified composites have applications in energy harvesting and electromagnetic shielding.
Addresses a Growing Need for the Development of Cellular and Porous Materials in Industry Building blocks used by nature are motivating researchers to create bio-inspired cellular structures that can be used in the development of products for the plastic, food, and biomedical industry. Representing a unified effort by international experts, Biofoams: Science and Applications of Bio-Based Cellular and Porous Materials highlights the latest research and development of biofoams and porous systems, and specifically examines the aspects related to the formation of gas bubbles in drink and food. The book offers a detailed analysis of bio-polymers and foaming technologies, biodegradable and sustainable foams, biomedical foams, food foams, and bio-inspired foams. Explores the Generation of New Materials with Wide-Ranging Technological Applicability This book introduces the science, technologies, and applications related to the use of biopolymers and biomaterials in the development of porous structures. It presents topics that include bio-based polymers for the development of biodegradable and sustainable polymeric foams, foams in food, foams in biomedical applications, biohybrids, and bio-inspired cellular and porous systems. It also includes recent studies on the design of polymer-based composites and hybrid scaffolds, weighs in on the challenges related to the production of porous polymers, and presents relevant examples of cellular architecture present in nature. In addition, this book: Focuses on materials compatible with natural tissues Discusses the engineering of bio-inspired scaffolds with the ability to mimic living tissue Reveals how to use renewable resources to develop more sustainable lightweight materials illustrates the state of the art of porous scaffold and process techniques A book dedicated to material science, Biofoams: Science and Applications of Bio-Based Cellular and Porous Materials focuses on food technology, polymers and composites, biomedical, and chemical engineering, and examines how the principles used in the creation of cellular structures can be applied in modern industry. Aerogels are the lightest solids known. Up to 1000 times lighter than glass and with a density as low as only four times that of air, they show very high thermal, electrical and acoustic insulation values and hold many entries in Guinness World Records. Originally based on silica, R&D efforts have extended this class of materials to non-silicate inorganic oxides, natural and synthetic organic polymers, carbon, metal and ceramic materials, etc. Composite systems involving polymer-crosslinked aerogels and interpenetrating hybrid networks have been developed and exhibit remarkable mechanical strength and flexibility. Even more exotic aerogels based on clays, chalcogenides, phosphides, quantum dots, and biopolymers such as chitosan are opening new applications for the construction, transportation, energy, defense and healthcare industries. Applications in electronics, chemistry, mechanics, engineering, energy production and storage, sensors, medicine, nanotechnology, military and aerospace, oil and gas recovery, thermal insulation and household uses are being developed with an estimated annual market growth rate of 70% until 2015. The Aerogels Handbook summarizes state-of-the-art developments and processing of inorganic, organic, and composite aerogels, including the most important methods of synthesis, characterization as well as their typical applications and their possible market impact. Readers will find an exhaustive overview of all aerogel materials known today, their fabrication, upscaling aspects, physical and chemical properties, and most recent advances towards applications and commercial products, some of which are commercially available today. Key Features: • Edited and written by recognized worldwide leaders in the field • Appeals to a broad audience of materials scientists, chemists, and engineers in academic research and industrial R&D • Covers inorganic, organic, and composite aerogels • Describes military, aerospace, building industry, household, environmental, energy, and biomedical applications among others. This collection gives broad and up-to-date results in the research and development of materials characterization and processing. Topics covered include characterization methods, ferrous materials, non-ferrous materials, minerals, ceramics, polymer and composites, powders, extraction, microstructure, mechanical behavior, processing, corrosion, welding, solidification, magnetic, electronic, environmental, nanomaterials, and advanced materials. The book explores scientific processes to characterize materials using modern technologies, and focuses on the interrelationships and interdependence among processing, structure, properties, and performance of materials. Advances in Aerogel Composites for Environmental Remediation presents both contextual information about aerogels and details about their application in environmental remediation. A wide variety of aerogels are discussed, ranging from common to advanced and from natural to synthetic. By exploring ongoing research and developments in the environmental remediation technologies using aerogel and its composites, this book addresses common day-to-day environmental problems and presents solutions to the use of aerogel materials. The chapters discuss fabrication of various aerogel composites, along with their design and applications toward different environmental remediation technologies. Additionally, the properties and advantages of aerogels are compared and contrasted to those of traditional materials. Given the consistent increase in environmental pollution, there is an urgent need to explore new materials for advances in remediation technology. Advances in Aerogel Composites for Environmental Remediation brings researchers and practitioners in the fields of environmental remediation, environmental science, and engineering to the forefront of remediation technologies with a thorough breakdown of the benefits and techniques relevant to aerogel composites. Covers basic properties, unique properties, and fabrication techniques of aerogels, from basic silica aerogels to present-day conventional aerogels Discusses most of the major environmental remediation techniques and advantages of using aerogels for these remediation techniques in comparison to using traditional methods Presents future prospects for utilizing aerogels in modern day-to-day life and in the fabrication of tangible new products Supramolecular Gels Discover a current and authoritative overview of the cutting-edge in supramolecular gels from a leading voice in the field A promising new class of materials shows potential and is receiving increasing attention as an intelligent material for multifunctional systems. In a work that is sure to be of great interest to a wide variety of researchers, chemists, and engineers, Supramolecular Gels: Materials and Emerging Applications delivers an application-oriented and focused book exploring the most recent applications of supramolecular gels. This interdisciplinary book presents the underlying fundamentals of supramolecular gels before discussing their assembly mechanisms and structures. It also introduces different material systems, including composite supramolecular gels, organogels, hydrogels, self-healing, and graphene-based supramolecular gels. The book discusses current and emerging applications of these materials in devices like sensors and actuators, biomedicines, and environmental applications. The distinguished author also offers valuable insights with respect to the design and character of brand-new versatile soft materials. Readers will also benefit from the inclusion of: A thorough introduction to the fundamentals of supramolecular gels, including their formation, classification, self-assembly, and mechanisms. An exploration of supramolecular chirality and regulation in gel structures, as well as self-assembly and environmental applications of composite supramolecular gels. Practical discussions of fluorescent organogels and hydrogels and their applications in analyte sensing. An examination of self-healing and graphene-based supramolecular gels, and supramolecular gels for sensors and actuators. Perfect for materials scientists, organic chemists, biochemists, catalytic chemists, and environmental chemists. Supramolecular Gels: Materials and Emerging Applications will also earn a place in the libraries of sensor developers and other professionals seeking a one-stop reference for this rapidly developing category of intelligent materials. This book addresses both classic concepts and state-of-the-art technologies surrounding cellulose science and technology. Integrating nanoscience and applications in materials, energy, biotechnology, and more, the book appeals broadly to students and researchers in chemistry, materials, energy, and environmental science. • Includes contributions from leading cellulose scientists worldwide, with five Anselm Payen Cellulose Award winners and two Hayashi Jisuke Cellulose Award winners. • Deals with a highly applicable and timely topic, considering the current activities in the fields of bioeconomies, biorefineries, and biomass utilization. • Maximizes readership by combining fundamental science and application development. Making innovative products for energy generation that decrease carbon footprints are the need of the hour. This book describes innovations
in porous materials for energy generation and storage applications that can have applications in developed as well as developing countries. It provides a comprehensive account of porous materials for potential new applications, such as catalysts for gas storage and energy efficient transformations, which engineers and scientists working in the areas of solar cells, batteries, supercapacitors, fuel cells, etc. will find to be of immense interest.

Exploring the range and utility of high-pressure solvent systems across a variety of different chemical applications, this book brings together recent advances in supercritical technology and other pressurised-solvent systems. It provides an in-depth overview of the latest advances and developments and discusses the limitations and drawbacks that need to be addressed. Wherever possible, the greenness and economic viability of the different solvent systems is highlighted. This book is ideal for researchers and industrialists working in environmental science, green chemistry and biorefineries. The book covers chapters ranging from introduction to recent technological challenges, case studies of energy-efficient buildings with policy and awareness issues, fundamentals and present status along with research updates and future aspects on topics focusing on energy-efficient construction, materials Provides comprehensive information on energy efficient buildings including policy and energy audit aspects with case studies Examines application of PCMs in passive heating and cooling in buildings; role of active TES and energy saving potential

This book considers the potential of new, smart materials and their use in architecture. It begins with an overview of current global tendencies (technological, demographic, and socio-anthropological) and their relevance for architectural design. Expanding upon approaches for flexible design solutions to address change and uncertainty, Dr. Kretzner begins by exploring adaptive architecture and proceeds to introduce the topic of “information materials,” which encompasses smart and functional materials, their current usage, and their potential for the creation of future spaces. The second chapter provides a comprehensive overview of architectural materials, past and present, split into the topics: natural, industrial, synthetic, digital, and information materials.

Chapter three introduces an educational approach for the mediation of information material usage in design courses and student workshops. The final section provides detailed information on a range of emerging material phenomena, including aerogels, bioluminescence, bio plastics, dye-sensitized solar cells, electroluminescent displays, electroactive polymers, soft robotics, and thermochromics. Each section explains its respective history, working principles, fabrication and (potential) usage in architecture and design, and provides hands-on tutorials on how to self-produce these materials, and displays class-tested experimental installations. The book concludes with an outlook into the domain of synthetic biology and the prospects of a “living” architecture. It is ideal for students of structural materials engineering, architecture, and urban planning; professionals working these in areas, as well as materials science/engineering and architecture educators.

This book presents the current state of knowledge on nanomaterials and their use in buildings, ranging from glazing and vacuum insulation to PCM composites. It also discusses recent applications in organic photovoltaics, photo-bioreactors, bioplastics and foams, making it an exciting read while also providing copious references to current research and applications for those wanting to pursue possible future research directions. Derek Clements-Croome, Emeritus Professor in Architectural Engineering, University of Reading (From the Foreword) Demonstrating how higher energy efficiency in new and existing buildings can help reduce global greenhouse gas emissions, this book details the way in which new technologies, manufacturing processes and products can serve to abate emissions from the energy sector and offer a cost-effective means of improving competitiveness and drive employment. Maximizing reader insights into how nano and biotech materials – such as aerogel based plasters, thermochromic glazings and thermal energy adsorbing glass, amongst others – can provide high energy efficiency performance in buildings, it provides practitioners in the field with an important high-tech tool to tackle key challenges and is essential reading for civil engineers, architects, materials scientists and researchers in the area of the sustainability of the built environment.
leading experts from around the globe who discuss the properties and applications of carbon-based materials, such as nanotubes (buckytubes), fullerenes, cones, horns, rods, foams, nanodiamonds and carbon black, and much more. Chapters provide cutting-edge, up-to-date research findings on the use of carbon-based materials in different application fields and illustrate how to achieve significant enhancements in physical, chemical, mechanical and thermal properties. Demonstrates systematic approaches and investigations from design, synthesis, characterization and applications of nanocarbon based composites. Aims to compile information on the various aspects of synthesis, properties and applications of nano-carbon based materials. Presents a useful reference and technical guide for university academics and postgraduate students (Masters and Ph.D.)

This book focuses on aerogels and their applications in such areas as energy storage, thermal storage, catalysis, water splitting and environmental remediation. The materials covered include nanocellulose-, porous-, silica-, hybrid silica-, carbon-, graphene- and magnetic aerogels. Ways of modulating the pore structure of aerogels are presented, as well as surface modifications and the application of coatings. Future perspectives focus on functional foods, thickeners, stabilizers, and scaffolding in tissue repair. Keywords: Aerogels, Nanocellulose Aerogels, Non-Silicate Aerogels, Organic Aerogels, Composite Hybrid Aerogels, Carbon-based and Graphene-based Aerogels, Biogels, Hybrid Silicon-based Aerogels, Energy Storage, Thermal Storage, Catalysis, Water Splitting, Environmental Remediation, Absorbents, Gas Filters, Packaging Materials, Electrical Devices, Thermal Insulations, Fire Retardants, Pharmaceutical and Biomedical Applications, Functional Foods, Thickeners, Stabilizers, Scaffolding in Tissue Repair.

Vol 2A: Basic Technologies Handbook of Crystal Growth, 2nd Edition Volume IIA (Basic Technologies) presents basic growth technologies and modern crystal cutting methods. Particularly, the methodical fundamentals and development of technology in the field of bulk crystallization on both industrial and research scales are explored. After an introductory chapter on the formation of minerals, ruling historically the basic crystal formation parameters, advanced basic technologies from melt, solution, and vapor being applied for research and production of the today most important materials, like silicon, semiconductor compounds and oxides are presented in detail. The interdisciplinary and general importance of crystal growth for human life are illustrated. Vol 2B: Growth Mechanisms and Dynamics Handbook of Crystal Growth, 2nd Edition Volume IIB (Growth Mechanisms and Dynamics) deals with characteristic mechanisms and dynamics accompanying each bulk crystal growth method discussed in Volume IIA. Before the atoms or molecules pass over from a position in the fluid medium (gas, melt or solution) to their place in the crystalline face they must be transported in the fluid over macroscopic distances by diffusion, buoyancy-driven convection, surface-tension-driven convection, and forced convection (rotation, acceleration, vibration, magnetic mixing). Further, the heat of fusion and the part carried by the species on their way to the crystal by conductive and convective transport must be dissipated in the solid phase by well-organized thermal conduction and radiation to maintain a stable propagating interface. Additionally, segregation and capillary phenomena play a decisional role for chemical composition and crystal shaping, respectively.

Today, the increase of high-quality crystal yield, its size enlargement and reproducibility are imperative conditions to match the strong economy. Volume 2A Presents the status and future of Czochralski and float zone growth of dislocation-free silicon Examines directional solidification of silicon ingots for photovoltaics, vertical gradient freeze of GaAs, CdTe for HF electronics and IR imaging as well as antiferromagnetic compounds and super alloys for turbine blades Focuses on growth of dielectric and conductor oxide crystals for lasers and non-linear optics Topics on hydrothermal, flux and vapour phase growth of III-nitrides, silicon carbide and diamond are explored Volume 2B Explores capillarity control of the crystal shape at the growth from the melt Highlights modeling of heat and mass transport dynamics Discusses control of convective melt processes by magnetic fields and vibration measures Includes imperative information on the segregation phenomenon and validation of compositional homogeneity. Examines crystal defect generation mechanisms and their controllability illustrates proper automation modes for ensuring constant crystal growth process. Exhibits fundamentals of solution growth, gel growth of protein crystals, growth of superconductor materials and mass crystallization for food and pharmaceutical industries.

Discover a rigorous treatment of aerogels processing and techniques for characterization with this easy-to-use reference. Presents the basics of aerogel synthesis and gelation to open porous nanostructures, and the processing of wet gels like ambient and supercritical drying leading to aerogels. Describes their essential properties with their measurement techniques and theoretical models used to analyse relations to their nanostructure. Linking the fundamentals and with practical applications, this is a useful toolkit for advanced undergraduates, and graduate students doing research in material and polymer science, physical chemistry, and chemical and environmental engineering.

Advancements in polymer nanocomposite foams have led to their application in a variety of fields, such as automotive, packaging, and insulation. Employing nanocomposites in foam formation enhances their property profiles, enabling a broader range of uses, from conventional to advanced applications. Since many factors affect the generation of nanost The book focuses on aerogels for biomedical applications, thermal insulation, energy storage, fuel cells, batteries and environmental remediation. Keywords: Aerogels, Biomedical Applications, Implantable Devices, Tissue Engineering, Bone Regeneration, Biosensing, Pharmaceutical Applications, Catalysts, Water Purification, Pesticides, Thermal Insulation, Energy Storage, Fuel Cells, Batteries, Environmental Remediation, Polymer Aerogels, Bioaerogels, Carbon-based Aerogels.

Aerogels have been in use for over 80 years and have been utilised in a wide variety of applications, in particular, there has been growing use of insulating nanoporous materials in the aerospace industry. Recent awareness of the environmental implications of materials has driven researchers to develop new green materials, with aerogels being developed using biobased constituents, such as polysaccharides and proteins. Recently, biobased components, such as cellulose nanocrystals, have replaced synthetic counterparts in the production of nanoporous materials. Biobased Aerogels is the first book to cover aerogel research from a green perspective, using commentary and analysis from.
leading researchers working in the field. Aerogels based on polysaccharides and proteins, their preparation and characterisation will be covered in detail, with further discussion highlighting properties such as surface morphology, shape recovery, mechanical properties and adsorption capacity. This insightful and timely publication will provide essential reading for those researchers and industrialists working within the green chemistry field.


This book The Transmission Electron Microscope abundantly illustrates necessary insight and guidance of this powerful and versatile material characterization technique with complete figures and thorough explanations. The second edition of the book presents deep understanding of new techniques from introduction to advance levels, covering in-situ transmission electron microscopy, electron and focused ion beam microscopy, and biological diagnostic through TEM. The chapters cover all major aspects of transmission electron microscopy and their uses in material characterization with special emphasis on both the theoretical and experimental aspects of modern electron microscopy techniques. It is believed that this book will provide a solid foundation of electron microscopy to the students, scientists, and engineers working in the field of material science and condensed matter physics.

Aerogels Handbook Springer Science & Business Media

This essential handbook provides comprehensive coverage of the current state-of-the-art in inorganic, organic, and composite aerogels, from synthesis and characterization through the latest applications and their possible market impact. Built on the successful Aerogels Handbook published in 2011, this book has been extensively revised and updated to reflect the changes in this fast-growing field. Aerogels are the lightest solids known to man. Up to 1000 times lighter than glass and with a density only four times that of air, they possess exceedingly high thermal, electrical, and acoustic insulation properties, and hold many entries in Guinness World Records. Originally based on silica, R&D efforts have extended this class of materials to incorporate non-silicate inorganic oxides, natural and synthetic organic polymers, carbon, metal, and ceramic materials. Composite systems involving polymer-crosslinked aerogels and interpenetrating hybrid networks have been developed and exhibit remarkable mechanical strength and flexibility. Even more exotic aerogels based on clays, chalcogenides, phosphides, quantum dots, and biopolymers such as chitosan are opening new applications for the construction, transportation, energy, defense and healthcare industries. Applications in electronics, chemistry, mechanics, engineering, energy production and storage, sensors, medicine, nanotechnology, military and aerospace, oil and gas recovery, thermal insulation, and household uses are being developed. Readers of this fully updated and expanded edition will find an exhaustive source for all aerogel materials known today, their fabrication, up scaling aspects, physical and chemical properties, and the most recent advances towards applications and commercial use. This key reference represents essential reading for a combined audience of graduate students, practicing academics, and industry researchers.

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. Handbook of Nanomaterials for Manufacturing Applications covers the challenges and obstacles involved in using nanomaterials in manufacturing. In particular, the lack of information, the possibility of adverse impacts on the environment, human health, safety and sustainability and other remaining challenges. This book addresses these challenges for the use of nanomaterials in major manufacturing sectors and suggests how they may be overcome. It was written to summarize, in a one-stop, concise manner, how nanomaterials and nanotechnology are being used to enhance current manufacturing techniques and processes in order to create more sustainable products in a range of industry sectors. This book will be of great use to materials scientists and engineers who are looking to gain a greater understanding on how nanotechnology is being used to improve the products we use in our daily

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lives. Demonstrates how cutting-edge developments in nanomaterials are being used to make more efficient manufacturing processes in a range of industry sectors. Explores how using nanomaterials can help engineers create innovative consumer products. Discusses the legal, economic and toxicity issues arising from using nanomaterials in manufacturing processes. This informative volume discusses recent advancements in the research and development in synthesis, characterization, processing, morphology, structure, and properties of advanced polymeric materials. With contributions from leading international researchers and professors in academic, government and industrial institutions, Advanced Polymeric Materials for Sustainability and Innovations has a special focus on eco-friendly polymers, polymer composites, nanocomposites, and blends and materials for traditional and renewable energy. In this book the relationship between processing-morphology-property applications of polymeric materials is well established. Recent advances in the synthesis of new functional monomers has shown strong potential in generating better property polymers from renewable resources. Fundamental advances in the field of nanocomposite blends and nanostructured polymeric materials in automotive, civil, biomedical and packaging/coating applications are the highlights of this book.

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