

Functional Hybrid Materials

Mechanically Responsive Materials for Soft Robotics Hideko Koshima 2020-02-18 Offers a comprehensive review of the research and development of mechanically responsive materials and their applications in soft robots. Mechanically Responsive Materials for Soft Robotics offers an authoritative guide to the current state of mechanically responsive materials for the development of soft robotics. With contributions from an international panel of experts, the book examines existing mechanically responsive materials such as crystals, polymers, gels, and composites that are stimulated by light and heat. The book also explores the application of mechanical materials to soft robotics. The authors describe the many excellent mechanical crystals developed in recent years that show the ability to bend, twist, rotate, jump, self-heal, and shape memory. Mechanical polymer materials are described for evolution into artificial muscles, photomobile materials, bioinspired soft actuators, inorganic-organic hybrid materials, multi-responsive composite materials, and strain sensor materials. The application of mechanical materials to soft robots is just the beginning. This book reviews the many challenging and versatile applications, such as soft microrobots made from photoresponsive elastomers, four-dimensional printing for assembling soft robots, self-growing of soft robots like plants, and biohybrid robots using muscle tissue. This important book: -Explores recent developments in the use of soft smart materials in robotic systems -Covers the full scope of mechanically responsive materials: polymers, crystals, gels, and nanocomposites -Deals with an interdisciplinary topic of advanced smart materials research -Contains extensive descriptions of current and future applications in soft robotics Written for materials scientists, polymer chemists, photochemists, physical chemists, solid state chemists, inorganic chemists, and robotics engineers, Mechanically Responsive Materials for Soft Robotics offers a comprehensive and timely review of the most recent research on mechanically responsive materials and the manufacture of soft robotics.

Novel Nanoscale Hybrid Materials Bhanu P. S. Chauhan 2018-01-31 A comprehensive and interdisciplinary resource filled with strategic insights, tools, and techniques for the design and construction of hybrid materials. Hybrid materials represent the best of material properties being combined for the development for materials with properties otherwise unavailable for application requirements. Novel Nanoscale Hybrid Materials is a comprehensive resource that contains contributions from a wide range of noted scientists from various fields, working on the hybridization of nanomolecules in order to generate new materials with superior properties. The book focuses on the new directions and developments in design and application of new materials, incorporating organic/inorganic polymers, biopolymers, and nanoarchitecture approaches. This book delves deeply into the complexities that arise when characteristics of a molecule change on the nanoscale, overriding the properties of the individual nanomolecules and generating new properties and capabilities altogether. The main topics cover hybrids of carbon nanotubes and metal nanoparticles, semiconductor polymer/biopolymer hybrids, metal biopolymer hybrids, bioorganic/inorganic hybrids, and much more. This important resource: Addresses a cutting-edge field within nanomaterials by presenting groundbreaking topics that address hybrid nanostructures Includes contributions from an interdisciplinary group of chemists, physicists, materials scientists, chemical and biomedical engineers Contains applications in a wide-range of fields—including biomedicine, energy, catalysis, green chemistry, graphene chemistry, and environmental science Offers expert commentaries that explore potential future avenues of future research trends Novel Nanoscale Hybrid Materials is an important resource for chemists, physicists, materials, chemical and biomedical engineers that offers the most recent developments and techniques in hybrid nanostructures.

Hybrid Polymer Composite Materials Vijay Kumar Thakur 2017-06-03 Hybrid Polymer Composite Materials: Applications provides a clear understanding of the present state-of-the-art and the growing utility of hybrid polymer composite materials. It includes contributions from world renowned experts and discusses the combination of different kinds of materials procured from diverse resources. In addition, this volume from the four volume series provides deep insights on the potential of hybrid polymer composite

materials for advanced applications. Provides a clear understanding of the present state-of-the-art and the growing utility of hybrid polymer composite materials Includes contributions from world renowned experts and discusses the combination of different kinds of materials procured from diverse resources Discusses their synthesis, chemistry, processing, fundamental properties, and applications Provides insights on the potential of hybrid polymer composite materials for advanced applications

Organic and Hybrid Materials for Large-area Functional Systems 2009

Clathrochelates Y.Z. Voloshin 2002-09-19 Clathrochelates are compounds which contain a metal ion encapsulated within a three dimensional cage of macrobicyclic ligand atoms. Within this cage the metal has unique properties and is to a great extent isolated from environmental factors. Such complexes are suitable as models of the most essential biological systems, membrane transport, electron carriers, highly selective and sensitive analytical reagents, catalysts for photochemical and redox processes, cation and anion receptors, etc. The aim of this monograph is to generalize and analyze experimental and theoretical data on clathrochelates in order to promote further research in this promising field of chemistry. Chapter 1 gives general concepts of complexes with encapsulated metal ions, discusses basic specific features of these compounds, considers and characterizes the main types of compounds with encapsulated metal ions and the main classes of clathrochelates, and includes the current nomenclature. Chapter 2 deals with the pathways of clathrochelate synthesis and the general procedures for the synthesis of macrobicyclic tris-dioximates, phosphorus-containing tris-diiminates, sepulchrates, sarcophagins, and polyene and other types of clathrochelate complexes. Chapter 3 concerns studies of the electronic and spatial structure of clathrochelate complexes. In Chapter 4, the kinetics and mechanism of synthesis and decomposition reactions of macrobicyclic tris-dioximates, sarcophagins, and sepulchrates in solution and gas phases are discussed. Chapter 5 considers the electrochemical, photochemical, and some other characteristics of clathrochelates and their applications associated with these characteristics. Finally, the practical applications of the unique properties of clathrochelates and perspectives on the synthesis of new clathrochelates are described in Chapters 6 and 7, respectively.

Cage Metal Complexes Yan Voloshin 2017-05-11 This fundamental book presents the most comprehensive summary of the current state in chemistry of cage metal complexes. After their previous book "The Encapsulation Phenomenon" (www.springer.com/978-3-319-27737-0) the authors in this book focus on the encapsulation of metal ions by different types of three-dimensional mono- and polynucleating caging ligands. Within these cage metal complexes, (metal) ions can be isolated from external factors. The book provides both a classification of the cage compounds and summaries of synthetic approaches. On that basis the authors then describe the unique chemical and physical properties and the resulting reactivity of the cage compounds, as well as practical and potential applications as potent topological drugs and prodrugs, antifibrillogenic agents, radiodiagnostic and radiotherapeutic compounds, paramagnetic probes, single-molecule magnets, electrocatalysts for hydrogen production, (photo)electronic devices, and many more. Readers will find a well-structured and concise overview, with particular emphasis on a review of synthesis and reactivity of various cage metal complexes, summarizing over 400 literature references, clearly presented in over 300 color schemes and figures.

Nanohybridization of Organic-Inorganic Materials Atsushi Muramatsu 2009-09-18 Synthesis and application of nanoparticles have been often reported by researchers in material science, chemistry and physics. While nanoparticles themselves are well known to exhibit fascinating characteristics. interest in their improvement and promotion is now turning to the hybridization of organic and/or inorganic nanomaterials. Although nano-level hybridization is an outstandingly novel and original technique, it encounters many difficulties to achieving the desired industrial application. To thoroughly review the research in this field, this book focuses on the synthesis, characterization and process of nano-hybrid materials, including nanoparticles and ultra-thin films. It elucidates the fundamental aspects of nano-hybrid materials in the synthesis procedure, characterization, and processes with selected examples, from both the basic science

and the engineering applications points of view. In fact, this is the first comprehensive compilation of new advances that covers the current status and topics of new synthetic information of nano-hybrid materials composed of organic and/or inorganic materials at the nano-meter level, in one volume. As such, the book provides a unique source of information and guidance for specialists and non-specialists alike.

Hybrid Nanomaterials Rafael Vargas-Bernal 2020-06-10 Two of the hottest research topics today are hybrid nanomaterials and flexible electronics. As such, this book covers both topics with chapters written by experts from across the globe. Chapters address hybrid nanomaterials, electronic transport in black phosphorus, three-dimensional nanocarbon hybrids, hybrid ion exchangers, pressure-sensitive adhesives for flexible electronics, simulation and modeling of transistors, smart manufacturing technologies, and inorganic semiconductors.

Graphene Production and Application Sadia Ameen 2020-05-06 Graphene is a super thin and strong material with potential to revolutionize the field of technology. As such, graphene is quickly attracting attention from researchers seeking to identify new concepts and applications of this "supermaterial." Graphene Production and Application is a comprehensive and easy-to-understand source of information on the advances in the growing research on graphene. Written by experts in the field, this book covers the topics of synthetic approaches, characterization techniques, and applications of graphene. It is ideally suited for a broad range of readers including students, instructors, and professionals.

Organic/Inorganic Hybrid Materials - 2004: Clément Sanchez 2014-06-05 Interest in hybrid materials has accelerated recently, in particular because tailoring materials properties through organization of organic/inorganic composites at nanometer length scales is now an important focus for numerous diverse research domains. This book's objective here is to create a communal forum for researchers involved in all areas of organic/inorganic hybrid materials to share perspectives, to learn about leading-edge science and engineering occurring around the world, and to develop new ideas. The book is divided into focus areas that address synthesis and characterization methods, functional hybrid materials, hybrid materials influenced by biology, structured mesoporous materials and materials with multiscale organization. Topics include: methods of patterning hybrid materials; hybrid materials for photonic applications; mesoporous films and monoliths; biofunctional materials; layered hybrid materials; applications-oriented hybrid materials; hybrid materials for electronics, optoelectronics and semiconductor applications; methods of characterizing hybrid materials; and novel synthetic methods.

Hybrid Nanocomposites for Nanotechnology Lhadi Merhari 2009-03-03 This book covers the latest advances in polymer-inorganic nanocomposites, with particular focus on high-added-value applications in fields including electronics, optics, magnetism and biotechnology. The unique focus of this book is on electronic, optical, magnetic and biomedical applications of hybrid nanocomposites. Coverage includes: Synthesis methods and issues and production scale-up; Characterization methods; Electronic applications; Optical applications and Photonics; Magnetic applications; and Biomedical applications. The book offers readers a solid grasp of the state of the art, and of current challenges in non-traditional applications of hybrid nanocomposites.

Organic-Inorganic Hybrid Materials Jesús-María García- Martínez 2021-10-27 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.

Silicon-Based Hybrid Nanoparticles Sabu Thomas 2021-09-24 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

Materials Research to Meet 21st-Century Defense Needs National Research Council 2003-03-25 In order to achieve the revolutionary new defense capabilities offered by materials science and engineering, innovative management to reduce the risks associated with translating research results will be needed along with the R&D. While payoff is expected to be high from the promising areas of materials research, many of the benefits are likely to be evolutionary. Nevertheless, failure to invest in more speculative areas of research could lead to undesired technological surprises. Basic research in physics, chemistry, biology, and materials science will provide the seeds for potentially revolutionary technologies later in the 21st century.

Hybrid Organic-Inorganic Interfaces Marie Helene Delville 2017-12-04 Hybrid organic-inorganic materials and the rational design of their interfaces open up the access to a wide spectrum of functionalities not achievable with traditional concepts of materials science. This innovative class of materials has a major impact in many application domains such as optics, electronics, mechanics, energy storage and conversion, protective coatings, catalysis, sensing and nanomedicine. The properties of these materials do not only depend on the chemical structure, and the mutual interaction between their nano-scale building blocks, but are also strongly influenced by the interfaces they share. This handbook focuses on the most recent investigations concerning the design, control, and dynamics of hybrid organic-inorganic interfaces, covering: (i) characterization methods of interfaces, (ii) innovative computational approaches and simulation of interaction processes, (iii) in-situ studies of dynamic aspects controlling the formation of these interfaces, and (iv) the role of the interface for process optimization, devices, and applications in such areas as optics, electronics, energy and medicine.

Hybrid Organic-Inorganic Interfaces Marie Helene Delville 2018-04-09 Hybrid organic-inorganic materials and the rational design of their interfaces open up the access to a wide spectrum of functionalities not achievable with traditional concepts of materials science. This innovative class of materials has a major impact in many application domains such as optics, electronics, mechanics, energy storage and conversion, protective coatings, catalysis, sensing and nanomedicine. The properties of these materials do not only depend on the chemical structure, and the mutual interaction between their nano-scale building blocks, but are also strongly influenced by the interfaces they share. This handbook focuses on the most recent investigations concerning the design, control, and dynamics of hybrid organic-inorganic interfaces, covering: (i) characterization methods of interfaces, (ii) innovative computational approaches and simulation of interaction processes, (iii) in-situ studies of dynamic aspects controlling the formation of these interfaces, and (iv) the role of the interface for process optimization, devices, and applications in such areas as optics, electronics, energy and medicine.

Main Group Strategies towards Functional Hybrid Materials Thomas Baumgartner 2018-03-12 Showcases the highly beneficial features arising from the presence of main group elements in organic materials, for the development of more sophisticated, yet simple advanced functional materials Functional organic materials are already a huge area of academic and industrial interest for a host of electronic applications such as Organic Light-Emitting Diodes (OLEDs), Organic Photovoltaics (OPVs), Organic Field-Effect Transistors (OFETs), and more recently Organic Batteries. They are also relevant to a plethora of functional sensory applications. This book provides an in-depth overview of the expanding field of functional hybrid materials, highlighting the incredibly positive aspects of main group centers and strategies that are furthering the creation of better functional materials. Main Group Strategies towards Functional Hybrid Materials features contributions from top specialists in the field, discussing the molecular, supramolecular and polymeric materials and applications of boron, silicon, phosphorus, sulfur, and their higher

homologues. Hypervalent materials based on the heavier main group elements are also covered. The structure of the book allows the reader to compare differences and similarities between related strategies for several groups of elements, and to draw crosslinks between different sections. The incorporation of main group elements into functional organic materials has emerged as an efficient strategy for tuning materials properties for a wide range of practical applications. Covers molecular, supramolecular and polymeric materials featuring boron, silicon, phosphorus, sulfur, and their higher homologues. Edited by internationally leading researchers in the field, with contributions from top specialists. Main Group Strategies towards Functional Hybrid Materials is an essential reference for organo-main group chemists pursuing new advanced functional materials, and for researchers and graduate students working in the fields of organic materials, hybrid materials, main group chemistry, and polymer chemistry.

Design and Characterisation of Nanostructured, Functional Hybrid Materials in Thin Films and Solutions Torsten Pietsch 2010

Bio-Synthetic Hybrid Materials and Bionanoparticles Alexander Boker 2015-08-18 There is much interest in using biological structures for the fabrication of new functional materials. Recent developments in the particle character and behaviour of proteins and viral particles have had a major impact on the development of novel nanoparticle systems with new functions and possibilities. Bio-Synthetic Hybrid Materials and Bionanoparticles approaches the subject by covering the basics of disciplines involved as well as recent advances in new materials. The first section of the book focusses on the design and synthesis of different bionanoparticles and hybrid structures including the use of genetic modification as well as by organic synthesis. The second section of the book looks at the self-assembling behaviour of bionanoparticles to form new materials. The final section looks at bionanoparticle-based functional systems and materials including chapters on biomedical applications and electronic systems and devices. Edited by leading scientists in bionanoparticles, the book is a collaboration between scientists with different backgrounds and perspectives which will initiate the next generation of bio-based structures, materials and devices.

Nanotubes and Nanofibers Yury Gogotsi 2006-06-20 Size, Shape, and Synthesis Key to "Tuning" Properties The discovery and rapid evolution of carbon nanotubes have led to a vastly improved understanding of nanotechnology, as well as dozens of possible applications for nanomaterials of different shapes and sizes ranging from composites to biology, medicine, energy, transportation, and electronic devices. Nanotubes and Nanofibers offers an overview of structure-property relationships, synthesis and purification, and potential applications of carbon nanotubes and fibers, including whiskers, cones, nanobelts, and nanowires. Using research on carbon nanotubes as a foundation to further developments, this book discusses methods for growing and synthesizing amorphous and nanocrystalline graphitic carbon structures and inorganic nanomaterials, including wet chemical synthesis, chemical vapor deposition (CVD), arc discharge, and others. It also describes boron nitride and metal chalcogenide nanotubes in detail and reviews the unique properties and methods for characterizing and producing single-crystalline semiconducting and functional-oxide nanowires. The chapters also identify challenges involving the controlled growth, processing, and assembly of organic and inorganic nanostructures that must be addressed before large-scale applications can be implemented. Edited by award-winning professor and researcher Dr. Yury Gogotsi, Nanotubes and Nanofibers offers a well-rounded perspective on the advances leading to improved nanomaterial properties for a range of new devices and applications including electronic devices, structural composites, hydrogen and gas storage, electrodes in electrochemical energy-storage systems, sorbents, and filters.

Hybrid Metal-Organic Framework and Covalent Organic Framework Polymers Bo Wang 2021-11-12 Metal-organic frameworks (MOFs) are crystalline porous materials constructed from metal ions/clusters and organic linkers, combining the merits of both organic and inorganic components. Due to high porosity, rich functionalities, well-defined open channels and diverse structures, MOFs show great potentials in field such as gas storage and separation, catalysis, and sensing. Combining them with polymers tunes their chemical, mechanical, electrical and optical properties, and endows MOFs with processability. Covalent organic frameworks (COFs) are crystalline porous materials built from organic molecular units with diverse structures and applications. Hybrid materials with intriguing properties can be achieved by appropriate preparation methods and careful selection of MOFs/COFs and polymers, broadening their potential applications. This book documents the latest research progress in MOF/COF-polymer hybrid materials and

reviews and summarises hybridization strategies to achieve MOF/COF polymeric composites. It also introduces various applications and potential applicable scenarios of hybrid MOF/COF polymers. Hybrid Metal-Organic Framework and Covalent Organic Framework Polymers offers an overview to readers who are new to this field, and will appeal to graduate students and researchers working on porous materials, polymers, hybrid materials, and supramolecular chemistry.

Hybrid Nanomaterials Bhanu P. S. Chauhan 2011-04-27 Hybrid nanomaterials are unique conjugates of organic/inorganic structures. Hybrid Nanomaterials: Synthesis, Characterization, and Applications presents the basic principles underlying the synthesis and fabrication of nanohybrids, their benefits, self-assembly and fabrication, and applications. This book discusses the most recent developments pertaining to the synthesis, characterizations, and applications of hybrid nanomaterials in a format that various disciplines can understand and use. Written by experts in this field, the text provides a fundamental insight into tricks, tools, and challenges associated with these technique or technology for engineers and scientists.

Functional Nanostructured Metal Oxide Hybrid Materials Based on M13 Phages Stefan Kilper 2019

Syntheses and Applications of Carbon Nanotubes and Their Composites Satoru Suzuki 2013-05-09 Carbon nanotubes are rolled up graphene sheets with a quasi-one-dimensional structure of nanometer-scale diameter. In these last twenty years, carbon nanotubes have attracted much attention from physicists, chemists, material scientists, and electronic device engineers, because of their excellent structural, electronic, optical, chemical and mechanical properties. More recently, demand for innovative industrial applications of carbon nanotubes is increasing. This book covers recent research topics regarding syntheses techniques of carbon nanotubes and nanotube-based composites, and their applications. The chapters in this book will be helpful to many students, engineers and researchers working in the field of carbon nanotubes.

Advanced Functional Materials Ashutosh Tiwari 2015-05-14 Because of their unique properties (size, shape, and surface functions), functional materials are gaining significant attention in the areas of energy conversion and storage, sensing, electronics, photonics, and biomedicine. Within the chapters of this book written by well-known researchers, one will find the range of methods that have been developed for preparation and functionalization of organic, inorganic and hybrid structures which are the necessary building blocks for the architecture of various advanced functional materials. The book discusses these innovative methodologies and research strategies, as well as provides a comprehensive and detailed overview of the cutting-edge research on the processing, properties and technology developments of advanced functional materials and their applications. Specifically, Advanced Functional Materials: Compiles the objectives related to functional materials and provides detailed reviews of fundamentals, novel production methods, and frontiers of functional materials, including metallic oxides, conducting polymers, carbon nanotubes, discotic liquid crystalline dimers, calixarenes, crown ethers, chitosan and graphene. Discusses the production and characterization of these materials, while mentioning recent approaches developed as well as their uses and applications for sensitive chemiresistors, optical and electronic materials, solar hydrogen generation, supercapacitors, display and organic light-emitting diodes, functional adsorbents, and antimicrobial and biocompatible layer formation. This volume in the Advanced Materials Book Series includes twelve chapters divided into two main areas: Part 1: Functional Metal Oxides: Architecture, Design and Applications and Part 2: Multifunctional Hybrid Materials: Fundamentals and Frontiers

Hybrid and Hierarchical Composite Materials Chang-Soo Kim 2015-04-08 This book addresses a broad spectrum of areas in both hybrid materials and hierarchical composites, including recent development of processing technologies, structural designs, modern computer simulation techniques, and the relationships between the processing-structure-property-performance. Each topic is introduced at length with numerous and detailed examples and over 150 illustrations. In addition, the authors present a method of categorizing these materials, so that representative examples of all material classes are discussed.

World Scientific Reference of Hybrid Materials (in 3 Volumes) Mato Knez 2019 "... Aims at giving the reader insight into various facets of fabrication of hybrid materials and their integration into applications. The three volumes cover aspects of hybrid polymeric materials, materials that are based on sol-gel chemistries and materials of electronic importance. Each of the volumes covers both fundamental and

applied aspects of the respective materials giving the reader the opportunity to understand different perspectives of the fascinating and truly multidisciplinary world of hybrid materials."--

Chemistry of Organo-hybrids Bernadette Charleux 2015-01-23 This book provides readers with a one-stop entry into the chemistry of varied hybrids and applications, from a molecular synthetic standpoint •

Describes introduction and effect of organic structures on specific support components (carbon-based materials, proteins, metals, and polymers). • Chapters cover hot topics including

nanodiamonds, nanocrystals, metal-organic frameworks, peptide bioconjugates, and chemoselective protein modification • Describes analytical techniques, with pros and cons, to validate synthetic strategies • Edited by internationally-recognized chemists from different backgrounds (synthetic polymer chemistry, inorganic surfaces and particles, and synthetic organic chemistry) to pull together diverse perspectives and approaches

Functional Hybrid Materials Pedro Gómez-Romero 2006-03-06 Functional Hybrid Materials consist of both organic and inorganic components, assembled for the purpose of generating desirable properties and functionalities. The aim is twofold: to bring out or enhance advantageous chemical, electrochemical, magnetic or electronic characteristics and at the same time to reduce or wholly suppress undesirable properties or effects. Another target is the creation of entirely new material behavior. The vast number of hybrid material components available has opened up a wide and diversified field of fascinating research. In this book, a team of highly renowned experts gives an in-depth overview, illustrating the superiority of well-designed hybrid materials and their potential applications.

Mesoporous Organic-Inorganic Non-Siliceous Hybrid Materials Yun-Pei Zhu 2014-11-28 This book provides extensive information on organic-inorganic hybrid materials with controllable compositions and structures developed over the past few decades, including metal sulfonates, carboxylates, phosphonates, metal-organic frameworks (MOFs), etc. A variety of judicious strategies for optimizing mesoporosity are also introduced, aiming at realizing the corresponding superiorities of hybrid frameworks in practical applications at the nano-/meso-scale. The morphological design and modification methods are also described in detail, which extend the potential application range of hybrid materials from traditional areas to high-tech fields. The book offers an ideal reference work for readers in the fields of chemistry, chemical engineering, physics, materials and biology, especially those who are interested in porous hybrid materials. Zhong-Yong Yuan is a Chair Professor at the College of Chemistry, Nankai University, China.

Functional Hybrid Materials for Phototheranostic Applications: from Organic to Inorganic Nanostructures Nilanjon Naskar 2023

The Supramolecular Chemistry of Organic-Inorganic Hybrid Materials Knut Rurack 2010-04-07 The combination of supramolecular chemistry, inorganic solids, and nanotechnology has already led to significant advances in many areas such as sensing, controlled motion, and delivery. By making possible an unprecedented tunability of the properties of nanomaterials, these techniques open up whole new areas of application for future supramolecular concepts. The Supramolecular Chemistry of Organic-Inorganic Hybrid Materials gathers current knowledge on the subject and provides an overview of the present state and upcoming challenges in this rapidly growing, highly cross- or interdisciplinary research field. The book details how these designed materials can improve existing materials or generate novel functional features such as chemical amplification, cooperative binding and signal enhancement that are difficult or not at all achievable by classical organic supramolecular chemistry. It also discusses issues related to nanofabrication or nanotechnology such as the directed and controlled assembly or disassembly, biomimetic functions and strategies, and the gating and switching of surface functions or morphology.

Polyoxometalate-Based Assemblies and Functional Materials Yu-Fei Song 2018-03-24 The authors of this volume concentrate on the recent progress of novel polyoxometalate (POM) syntheses, as well as advances made in catalytic, electrochemical, and sensing systems. The state-of-the-art techniques such as flow system and gel-electrophoresis for the discovery of POMs are covered with a detailed discussion. Of particular importance, the application of POM-based materials in photo-sensing, heterogeneous catalysis, energy conservation and storage, and gas separation is reviewed. Over the past few years, POM chemistry has witnessed a remarkable progress with more than 1500 papers published each year. Due to their intrinsic structural features, POMs are considered as versatile building blocks for the construction of

sophisticated complex assemblies and advanced multi-functional materials. Various strategies, methods, and techniques have been adopted to develop POM-based materials with intriguing properties and excellent performance. All the contributors to this volume are young, vibrant chemists in this research field and all the works are carefully collected from the authors' years of experience. This volume serves as an essential reference for every POM chemist and is of great interest to new researchers who wish to learn more about this area.

Photocatalytic Functional Materials for Environmental Remediation Alagarsamy Pandikumar 2019-06-10 A comprehensive volume on photocatalytic functional materials for environmental remediation As the need for removing large amounts of pollution and contamination in air, soil, and water grows, emerging technologies in the field of environmental remediation are of increasing importance. The use of photocatalysis—a green technology with enormous potential to resolve the issues related to environmental pollution—breaks down toxic organic compounds to mineralized products such as carbon dioxide and water. Due to their high performance, ease of fabrication, long-term stability, and low manufacturing costs, photofunctional materials constructed from nanocomposite materials hold great potential for environmental remediation. Photocatalytic Functional Materials for Environmental Remediation examines the development of high performance photofunctional materials for the treatment of environmental pollutants. This timely volume assembles and reviews a broad range of ideas from leading experts in fields of chemistry, physics, nanotechnology, materials science, and engineering. Precise, up-to-date chapters cover both the fundamentals and applications of photocatalytic functional materials. Semiconductor-metal nanocomposites, layered double hydroxides, metal-organic frameworks, polymer nanocomposites, and other photofunctional materials are examined in applications such as carbon dioxide reduction and organic pollutant degradation. Providing interdisciplinary focus to green technology materials for the treatment of environmental pollutants, this important work: Provides comprehensive coverage of various photocatalytic materials for environmental remediation useful for researchers and developers Encompasses both fundamental concepts and applied technology in the field Focuses on novel design and application of photocatalytic materials used for the removal of environmental contaminants and pollution Offers in-depth examination of highly topical green-technology solutions Presents an interdisciplinary approach to environmental remediation Photocatalytic Functional Materials for Environmental Remediation is a vital resource for researchers, engineers, and graduate students in the multi-disciplinary areas of chemistry, physics, nanotechnology, environmental science, materials science, and engineering related to photocatalytic environmental remediation.

Functional Materials Processing for Switchable Device Modulation Kaushik Pal 2021-10-19 Functional Materials Processing for Switchable Device Modulation focuses on the advances of nanofabrication that underpin emerging technologies, including electronic devices. The book provides readers with a broad view of the materials' perspectives, including historical context and background, along with future opportunities for smart electronic and switchable devices. A major focus in the book is on the research and development of synthetic materials for spectroscopic analysis which broadly deals with science and technology of materials on the atomic and molecular scale. The book reviews the materials and advances in research for switchable electronics for bioelectronic, sensing and optoelectronic applications. In addition, key challenges and emerging opportunities in innovations in surface modification and novel functional materials device implementation for industrial scale reproducibility are discussed. The book covers the applications and market potential for a variety of media, including mirrors, glazing/coatings, and display products. The physics, electrochemistry, device design and materials are detailed, with performance compared between the most relevant and emerging switchable technologies. Addresses the most interesting advances in switchable devices for bioelectronics, electronics, optoelectronics and sensing applications Includes a special emphasis on materials design, processing and fabrication of switchable devices to realize large-scale industry applications Compares the performance of existing innovative switchable devices Reviews the remaining barriers to commercialization, along with opportunities to address these challenges

Polymer/POSS Nanocomposites and Hybrid Materials Susheel Kalia 2018-11-27 This book provides an overview of polymer nanocomposites and hybrid materials with polyhedral oligomeric silsesquioxanes (POSS). Among inorganic nanoparticles, functionalized POSS are unique nano-building blocks that can be

used to create a wide variety of hybrid and composite materials, where precise control of nanostructures and properties is required. This book describes the influence of incorporation of POSS moieties into (organic) polymer matrices on the mechanical, thermal and flammability behavior of composites and hybrid organic-inorganic materials. Importantly, POSS-containing materials can be bio-functionalized by linking e.g. peptides and growth factors through appropriate surface modification in order to enhance the haemocompatibility of cardiovascular devices made of these materials. This volume includes descriptions of synthesis routes of POSS and POSS-containing polymeric materials (e.g. based on polyolefines, epoxy resins and polyurethanes), presentation of POSS' role as flame retardants and as biocompatible linker, as well as the depiction of decomposition and ageing processes.

Hybrid Perovskite Composite Materials Imran Khan 2020-10-22 Hybrid Composite Perovskite Materials: Design to Applications discusses the manufacturing, design and characterization of organic-inorganic perovskite composite materials. The book goes beyond the basics of characterization and discusses physical properties, surface morphology and environmental stability. Users will find extensive examples of real-world products that are suitable for the needs of the market. Following a logical order, the book begins with mathematical background and then covers innovative approaches to physical modeling, analysis and design techniques. Numerous examples illustrate the proposed methods and results, making this book a sound resource on the modern research application of perovskite composites with real commercial value. Discusses the composition of perovskite materials and their properties, manufacturing and environmental stability Includes both fundamentals and state-of-the-art developments Features the main types of applications, including solar cells, photovoltaics, sensors and optoelectronic devices

Functional Hybrid Nanomaterials for Environmental Remediation Ahmad Fauzi Ismail 2021-10-01 Functional and structural nanomaterials are emerging materials that display interesting physical and chemical properties because of their size and surface area to volume ratio. Applications for these materials include uses in removing pollutants from the environment. Looking at the current state-of-the-art as well as future trends in the use of nanomaterials for tackling environmental issues this book covers everything from the synthesis and characterisation of these materials to their use in the removal of specific contaminants. Functional Hybrid Nanomaterials for Environmental Remediation is a useful resource both for nanomaterial scientists interested in the real world application of hybrid nanomaterials and for environmental chemists and environmental engineers interested in novel materials for environmental remediation.

Polymer Hybrid Materials and Nanocomposites Tawfik Abdo Saleh 2021-08-28 Polymer Hybrid Materials and Composites: Fundamentals and Applications presents an introduction to the principles behind polymeric hybrid materials, providing both theoretical and practical information on the synthesis and application of these materials. It documents the latest innovations, ranging from materials development and characterization of properties, to applications. Sections cover the route from laboratory to industry, providing practical, actionable guidance to assist the scaling up process for applications in areas including energy technology, solar cells, water purification, medical devices, optical and electrical devices, and more. It is an essential introduction to the emerging technologies that are made possible by these advanced materials. Documents the latest innovations in the technology, thus enabling new applications Provides significant and detailed information on the engineering of hybrid materials for a wide range of areas, including energy, medical, and electronics, among others

[Modelling of Functional Hybrid Organic-inorganic Materials](#) Raimondas Galvelis 2012

Functional Hybrid Materials

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