Nanoparticle technology, which handles the preparation, processing, application and characterisation of nanoparticles, is a new and revolutionary technology. It becomes the core of nanotechnology as an extension of the conventional Fine Particle / Powder Technology. Nanoparticle technology plays an important role in the implementation of nanotechnology in many engineering and industrial fields including electronic devices, advanced ceramics, new batteries, engineered catalysts, functional paint and ink, Drug Delivery System, biotechnology, etc.; and makes use of the unique properties of the nanoparticles which are completely different from those of the bulk materials. This new handbook is the first to explain complete aspects of nanoparticles with many application examples showing their advantages and advanced development. There are handbooks which briefly mention the nanosized particles or their related applications, but no handbook describing the complete aspects of nanoparticles has been published so far. The handbook elucidates of the basic properties of nanoparticles and various nanostructural materials with their characterisation methods in the first
part. It also introduces more than 40 examples of practical and potential uses of nanoparticles in the later part dealing with applications. It is intended to give readers a clear picture of nanoparticles as well as new ideas or hints on their applications to create new materials or to improve the performance of the advanced functional materials developed with the nanoparticles. * Introduces all aspects of nanoparticle technology, from the fundamentals to applications. * Includes basic information on the preparation through to the characterization of nanoparticles from various viewpoints * Includes information on nanostructures, which play an important role in practical applications.

The book contains a selection of peer-reviewed papers that have been presented at the 2nd International Conference on Optical, Electronic and Electrical Materials. Volume is indexed by Thomson Reuters CPCI-S (WoS). The topics of the 82 selected papers cover optical materials, electronic materials, electrical materials, magnetic materials, dielectric materials and optoelectronic devices. It provides a lot of useful information for ordinary readers as well as materials scientists and engineers who wish to understand the most recent development in the materials science field of semiconductors, dielectrics and optoelectronic devices.

This book presents a comprehensive and broad-spectrum picture of the state-of-the-art research, development, and commercial prospective of various discoveries conducted in the real world of functional and smart materials. This book presents various synthesis and fabrication routes of function and smart materials for universal applications such as material science, mechanical engineering, manufacturing, metrology, nanotechnology, physics, biology, chemistry, civil engineering, and food science. The content of this book opens various scientific horizons proved to be beneficial for uplifting the standards of day-to-day practices in the biomedical domain. Myriad innovations in the materials science and engineering are transforming our everyday lives in extraordinary ways. This book captures the emerging areas of materials science and advanced manufacturing engineering and presents recent trends in research for researchers, field engineers, and academic professionals.

Through advanced characterization and new fabrication techniques, the physics, chemistry, and structure of functional materials have become a central focus of investigation in materials science, chemistry, physics, and engineering. This book presents a detailed overview of recent research developments on functional materials, including nanomaterials, synthesis, characterization, and applications. A series of chapters provides state-of-the-art information on structures and performance of polymer composites. This volume contains topical articles by prominent leaders in this field. The research presented discusses design principles, candidate materials and systems, and current advances, and serves as a useful source of insight into this field. This book provides a strong understanding of the primary types of materials and composites, as well as the relationships that exist between the structural elements of
materials and their properties. The relationships among processing, structure, properties, and performance components are explored throughout the chapters.

This book describes the latest research on nanopolysaccharides in the development of functional materials, from their preparation, properties and functional modifications to the architecture of diverse functional materials. Polysaccharide-based nanoparticles, including nanocellulose, nanochitin, and nanostarch have attracted interest in the field of nanoscience, nanotechnology, and materials science that encompasses various industrial sectors, such as biomedicine, catalyst, coating, energy, optical materials, environmental materials, construction materials, and antibacterial materials. This book establishes a fundamental framework, highlighting the architecture strategies of typical functional systems based on nanopolysaccharides and integrated analysis of their significant influence and properties to various functional behaviors of materials, to help readers to fully understand the fundamental features of nanopolysaccharides and functional materials. Addressing the potential for practical applications, the book also covers the related industrial interests and reports on highly valued products from nanopolysaccharides, providing ideas for future studies in the area. Intended both for academics and professionals who are interested in nanopolysaccharides, it is also a valuable resource for postgraduate students, researchers, and engineers involved in R&D of natural polymers, nanotechnology, and functional materials.

Lignocellulosics: Renewable Feedstock for (Tailored) Functional Materials and Nanotechnology gives a comprehensive overview of recent advances in using lignocellulosic substrates in materials science and nanotechnology. The functionalization and processing of lignocellulosics are described via a number of examples that cover films, gels, sensors, pharmaceutics and energy storage. In addition to the research related to functional cellulose nanomaterials, there has been an increased interest in research on lignin and lignocellulosics. This book explains how utilizing biomaterials as a raw material allows ambitious reconstruction of smart materials that are green and multifunctional. As lignin as a valuable material has gained a lot of attention in the last few years, shifting from purely extraction and fundamental characterization, and now also focusing on the preparation of exciting materials, such as nanoparticles, readers will find this to be a comprehensive resource on the topic. Provides a detailed description of functional lignocellulosic materials and their properties Brings together research advances in the areas of chemistry, chemical engineering, physics and materials science Concentrates on the fundamental properties of lignocellulose Includes unique coverage of lignin research

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

The book provides a unique collection of 15 contributions by 15 internationally recognized scientists performing intensive research activity on the preparation and characterization of complex and multiphase materials based on macromolecules as well as on the evaluation and simulation of structure/properties relations. The topic is assuming a general increasing importance as providing a highly sustainable and modern approach to the present and future development of the important area of materials science and technology. The scientific route along the successive contributions goes from the controlled preparation of functional MM both by innovative polymerization reactions and preformed polymers modification (intramacromolecular complexity), to their combination with other MMs and materials to give blends and composites where new properties are conveniently achieved by morphologic complexity. The synergic behaviour of the different components in these last is obtained by reactive processing producing the necessary interfacial adhesion. Even if most examples deal with man-made MMs, biopolymers are also included. The various chapters provide in most cases an exhaustive fundamental description assisted by an up-to-date and broad list of relevant references. The book is therefore an excellent informative and formative instrument for those involved in complex materials preparation and application in research and industry.

As the characteristic dimensions of electronic devices continue to shrink, the ability to characterize their electronic properties at the nanometer scale has come to be of outstanding importance. In this sense, Scanning Probe Microscopy (SPM) is becoming an indispensable tool, playing a key role in nanoscience and nanotechnology. SPM is opening new
opportunities to measure semiconductor electronic properties with unprecedented spatial resolution. SPM is being successfully applied for nanoscale characterization of ferroelectric thin films. In the area of functional molecular materials it is being used as a probe to contact molecular structures in order to characterize their electrical properties, as a manipulator to assemble nanoparticles and nanotubes into simple devices, and as a tool to pattern molecular nanostructures. This book provides in-depth information on new and emerging applications of SPM to the field of materials science, namely in the areas of characterisation, device application and nanofabrication of functional materials. Starting with the general properties of functional materials the authors present an updated overview of the fundamentals of Scanning Probe Techniques and the application of SPM techniques to the characterization of specified functional materials such as piezoelectric and ferroelectric and to the fabrication of some nano electronic devices. Its uniqueness is in the combination of the fundamental nanoscale research with the progress in fabrication of realistic nanodevices. By bringing together the contribution of leading researchers from the materials science and SPM communities, relevant information is conveyed that allows researchers to learn more about the actual developments in SPM applied to functional materials. This book will contribute to the continuous education and development in the field of nanotechnology.

Functional materials have assumed a very prominent position in several high-tech areas. Such materials are not being classified on the basis of their origin, nature of bonding or processing techniques but are classified on the basis of the functions they can perform. This is a significant departure from the earlier schemes in which materials were described as metals, alloys, ceramics, polymers, glass materials etc. Several new processing techniques have also evolved in the recent past. Because of the diversity of materials and their functions it has become extremely difficult to obtain information from single source. Functional Materials: Preparation, Processing and Applications provides a comprehensive review of the latest developments. Serves as a ready reference for Chemistry, Physics and Materials Science researchers by covering a wide range of functional materials in one book Aids in the design of new materials by emphasizing structure or microstructure – property correlation Covers the processing of functional materials in detail, which helps in conceptualizing the applications of them

A must-have resource to the booming field of sulfur-containing polymers Sulfur-Containing Polymers is a state-of-the-art text that offers a synthesis of the various sulfur-containing polymers from low-cost sulfur resources such as elemental sulfur, carbon disulfide (CS2), carbonyl sulfide (COS) and mercaptan. With contributions from noted experts on the topic, the book presents an in-depth understanding of the mechanisms related to the synthesis of sulfur-containing polymers. The book also includes a review of the various types of sulfur-containing polymers, such as: poly(thioester)s, poly(thioether)s and poly(thiocarbonate)s and poly(thiourethane)s with linear or
hyperbranched (dendrimer) architectures. The expert authors provide the fundamentals on the structure-property relationship and applications of sulfur-containing polymers. Designed to be beneficial for both research and application-oriented chemists and engineers, the book contains the most recent research and developments of sulfur-containing polymers. This important book: Offers the first comprehensive handbook on the topic Contains state-of-the-art research on synthesis of sulfur containing polymers from low-cost sulfur-containing compounds Examines the synthesis, mechanism, structure properties, and applications of various types of sulfur-containing polymers Includes contributions from well-known experts Written for polymer chemists, materials scientists, chemists in industry, biochemists, and chemical engineers, Sulfur-Containing Polymers offers a groundbreaking text to the field with information on the most recent research.

This book represents a unique collection of the latest developments in the rapidly developing world of optoelectronics. The contributing authors to this book are a group of internationally distinguished researchers. This book consists of a collection of chapters divided into two sections, with the first section covering new applications and the second section covering materials and crystal structures topics to support future generations of optoelectronic devices and open the door for future, more demanding applications. This collection of chapters will be of considerable interest to scientists, engineers, physicists, and technologists working in research and development in the fields of optoelectronics and photonics, as well as to young researchers who are at the beginning of their career.

This book includes updated theoretical considerations which provide an insight into avenues of research most likely to result in further improvements in material performance. It details the latest techniques for the preparation of thermoelectric materials employed in energy harvesting, together with advances in the thermoelectric characterisation of nanoscale material. The book reviews the use of neutron beams to investigate phonons, whose behaviour govern the lattice thermal conductivity and includes a chapter on patents.

The current automotive industry faces numerous challenges, including increased global competition, more stringent environmental and safety requirements, the need for higher performance vehicles, and reducing costs. The materials used in automotive engineering play key roles in overcoming these issues. Automotive Engineering: Lightweight, Functional, and Novel Materials focuses on both existing materials and future developments in automotive science and technology. Divided into four sections, the book first describes the development of future vehicles, aluminum alloys for manufacturing lighter body panels, and various polymer composites for stronger module carriers. It then reviews state-of-the-art functional materials and smart technologies and projects in which application areas they will most impact future automotive designs and manufacturing. The next section considers the difficulties that must be
overcome for light alloys to displace ferrous-based materials and the increasing competition from lightweight polymeric-based composites. The final section explores newer processing and manufacturing technologies, including welding and joining, titanium alloys, and durable, high-performance composites. With contributions from internationally recognized experts, this volume provides a comprehensive overview of cutting-edge automotive materials and technologies. It will help you understand the key materials and engineering concerns currently confronting this industry.

Materials Under Extreme Conditions: Recent Trends and Future Prospects analyzes the chemical transformation and decomposition of materials exposed to extreme conditions, such as high temperature, high pressure, hostile chemical environments, high radiation fields, high vacuum, high magnetic and electric fields, wear and abrasion related to chemical bonding, special crystallographic features, and microstructures. The materials covered in this work encompass oxides, non-oxides, alloys and intermetallics, glasses, and carbon-based materials. The book is written for researchers in academia and industry, and technologists in chemical engineering, materials chemistry, chemistry, and condensed matter physics. Describes and analyzes the chemical transformation and decomposition of a wide range of materials exposed to extreme conditions Brings together information currently scattered across the Internet or incoherently dispersed amongst journals and proceedings Presents chapters on phenomena, materials synthesis, and processing, characterization and properties, and applications Written by established researchers in the field

This book was written by authors in the field of preparation of advanced functional materials and their wide-ranging applications. The topics in the book include: preparation of several advanced functional materials, and their applications in sensors, health, concrete, textile, glasses, and pharmacy. In this book, the authors focused on recent studies, applications, and new technological developments in fundamental properties of advanced functional materials.

In the search for new functional materials, a clear understanding about the relationship between the physical properties and the atomic-scale structure of materials is needed. Here, the authors provide graduate students and scientists with an in-depth account of the evolutionary behavior of oxide functional materials within specific structural systems, discussing the intrinsic connections among these different structural systems. Over 300 illustrations and key appendices support the text.

Global demand for low cost, efficient and sustainable energy production is ever increasing. Driven by recent discoveries and innovation in the science and technology of materials, applications based on functional materials are becoming increasingly important. Functional materials for sustainable energy applications provides an essential guide to the development and application of these materials in sustainable energy
production. Part one reviews functional materials for solar power, including silicon-based, thin-film, and dye sensitized photovoltaic solar cells, thermophotovoltaic device modelling and photoelectrochemical cells. Part two focuses on functional materials for hydrogen production and storage. Functional materials for fuel cells are then explored in part three where developments in membranes, catalysts and membrane electrode assemblies for polymer electrolyte and direct methanol fuel cells are discussed, alongside electrolytes and ion conductors, novel cathodes, anodes, thin films and proton conductors for solid oxide fuel cells. Part four considers functional materials for demand reduction and energy storage, before the book concludes in part five with an investigation into computer simulation studies of functional materials.

With its distinguished editors and international team of expert contributors, Functional materials for sustainable energy applications is an indispensable tool for anyone involved in the research, development, manufacture and application of materials for sustainable energy production, including materials engineers, scientists and academics in the rapidly developing, interdisciplinary field of sustainable energy. An essential guide to the development and application of functional materials in sustainable energy production.

This book is the first comprehensive collection of electronic aspects of different kinds of elastomer composites, including combinations of synthetic, natural and thermoplastic elastomers with different conducting fillers like metal nanoparticles, carbon nanotubes, or graphenes, and many more. It covers elastomer composites, which are useful in electronic applications, including chemical and physical as well as material science aspects. The presented elastomer composites have great potential for solving emerging new material application requirements, for example as flexible and wearable electronics. The book is structured and organized by the rubber/elastomer type: each chapter describes a different elastomer matrix and its composites. While introducing to important fundamentals, it is application-oriented, discussing the current issues and challenges in the field of elastomer composites. This book will thus appeal to researchers and scientists, to engineers and technologists, but also to graduate students, working on elastomer composites, or on electronics engineering with the composites, providing the readers with a sound introduction to the field and solutions to both fundamental and applied problems.

This book looks at the synthesis of polyaniline by different methods, under different conditions, for various applications, and presents studies of its properties by a wide range of the modern physic-chemical methods. The book provides a comprehensive analysis of experimental results from the point of view of the correlations in the triad synthesis conditions-structure-physico-chemical properties. It combines the results of experimental investigations and original methodology of the description of physical-chemical and electrochemical phenomena at
interface surfaces, showing an influence of such phenomena on the applied aspects of the polyaniline and nanocomposites on its basis applications.

Mechanical Alloying: Energy Storage, Protective Coatings, and Medical Applications, Third Edition is a detailed introduction to mechanical alloying that offers guidelines on the necessary equipment and facilities needed to carry out the process, also giving a fundamental background to the reactions taking place. El-Eskandarany, a leading authority on mechanical alloying, discusses the mechanism of powder consolidations using different powder compaction processes. A new chapter is included on utilization of the mechanically alloyed powders for thermal spraying. Fully updated to cover recent developments in the field, this second edition also introduces new and emerging applications for mechanical alloying, including the fabrication of carbon nanotubes, surface protective coating and hydrogen storage technology. El-Eskandarany discusses the latest research into these applications and provides engineers and scientists with the information they need to implement these developments. Guides readers through each step of the mechanical alloying process Includes tables and graphs that are used to explain the stages of the milling processes Presents a comprehensive update on the previous edition, including new chapters that cover emerging applications.

Handbook of Smart Photocatalytic Materials: Environment, Energy, Emerging Applications and Sustainability provides an intriguing and useful guide to catalysis and materials. The handbook covers applications of smart photocatalytic materials for energy environmental protection and emerging fields. Also covered is the safety risk of Smart Photocatalytic Materials, commercialization, their fate and transportation in the environment, and sustainability. This volume provides a valuable roadmap, outlining common principles behind their use. Every chapter of this volume presents state-of-the-art knowledge on sustainable practices of smart photocatalytic materials (SPMs), including concepts of theory and practice. This handbook is a valued reference for both the academic and industrial researchers looking for recent developments in the field. Covers all aspects of recent developments in Environmental, Energy and Emerging applications of Smart Photocatalytic Materials Focuses on advanced applications and future research advancements of Smart Photocatalytic Materials Emphasizes the sustainability aspect of Smart Photocatalytic Materials Presents a valuable reference for researchers and students that stimulates interest in designing smart materials.

A comprehensive review of ion beam application in modern materials research is provided, including the basics of ion beam physics and technology. The physics of ion-solid interactions for ion implantation, ion beam synthesis, sputtering and nano-patterning is treated in detail. Its applications in materials research, development and analysis, developments of special techniques and interaction mechanisms of ion beams with solid state matter result in the optimization of new material properties, which are discussed thoroughly. Solid-state properties
optimization for functional materials such as doped semiconductors and metal layers for nano-electronics, metal alloys, and nano-patterned surfaces is demonstrated. The ion beam is an important tool for both materials processing and analysis. Researchers engaged in solid-state physics and materials research, engineers and technologists in the field of modern functional materials will welcome this text.

Conducting Polymer-Based Nanocomposites: Fundamentals and Applications delivers an up-to-date overview on cutting-edge advancements in the field of nanocomposites derived from conjugated polymeric matrices. Design of conducting polymers and resultant nanocomposites has instigated significant addition in the field of modern nanoscience and technology. Recently, conducting polymer-based nanocomposites have attracted considerable academic and industrial research interest. The conductivity and physical properties of conjugated polymers have shown dramatic improvement with nanofiller addition. Appropriate fabrication strategies and the choice of a nanoreinforcement, along with a conducting matrix, may lead to enhanced physicochemical features and material performance. Substantial electrical conductivity, optical features, thermal stability, thermal conductivity, mechanical strength, and other physical properties of the conducting polymer-based nanocomposites have led to high-performance materials and high-tech devices and applications. This book begins with a widespread impression of state-of-the-art knowledge in indispensable features and processing of conducting polymer-based nanocomposites. It then discusses essential categories of conducting polymer-based nanocomposites such as polyaniline, polypyrrole, polythiophene, and derived nanomaterials. Subsequent sections of this book are related to the potential impact of conducting polymer-based nanocomposites in various technical fields. Significant application areas have been identified for anti-corrosion, EMI shielding, sensing, and energy device relevance. Finally, the book covers predictable challenges and future opportunities in the field of conjugated nanocomposites. Integrates the fundamentals of conducting polymers and a range of multifunctional applications Describes categories of essential conducting polymer-based nanocomposites for polyaniline, polypyrrole, polythiophene, and derivative materials Assimilates the significance of multifunctional nanostructured materials of nanocomposite nanofibers Portrays current and future demanding technological applications of conjugated polymer-based nanocomposites, including anti-corrosion coatings, EMI shielding, sensors, and energy production and storage devices.

With recent developments in the polymer, ceramic, sensor, and fuel cell technology, a range of novel materials have been manufactured for advanced, compact, and electronic industry. Polymers, silicon, energy materials have received much attention in recent years. "Advanced Functional Materials" gives the most recent research results on polymer, fine ceramics, sensor, and green fuel cells. The content of this book, mainly based on the authors' recent research results, covers a broad spectrum including: the advanced inorganic-organic-hybrid polymeric
materials, high functional sensor, and microbial fuel cells. The book is suitable for the researchers working in the areas of polymer, nanotechnology, ceramic engineering, engineering thermoplastic, energy and power engineering, chemical engineering and materials, etc. Hee-Gweon Woo is a professor at the Department of Chemistry, Chonnam National University, the Republic of Korea. Hong Li is a professor at the Institute of Polymer Chemistry, Nankai University, China.

As one of the eighteen field-specific reports comprising the comprehensive scope of the strategic general report of the Chinese Academy of Sciences, this sub-report addresses long-range planning for developing science and technology in the field of advanced materials science. They each craft a roadmap for their sphere of development to 2050. In their entirety, the general and sub-group reports analyze the evolution and laws governing the development of science and technology, describe the decisive impact of science and technology on the modernization process, predict that the world is on the eve of an impending S&T revolution, and call for China to be fully prepared for this new round of S&T advancement. Based on the detailed study of the demands on S&T innovation in China's modernization, the reports draw a framework for eight basic and strategic systems of socio-economic development with the support of science and technology, work out China's S&T roadmaps for the relevant eight basic and strategic systems in line with China's reality, further detail S&T initiatives of strategic importance to China's modernization, and provide S&T decision-makers with comprehensive consultations for the development of S&T innovation consistent with China's reality. Supported by illustrations and tables of data, the reports provide researchers, government officials and entrepreneurs with guidance concerning research directions, the planning process, and investment. Founded in 1949, the Chinese Academy of Sciences is the nation's highest academic institution in natural sciences. Its major responsibilities are to conduct research in basic and technological sciences, to undertake nationwide integrated surveys on natural resources and ecological environment, to provide the country with scientific data and consultations for government's decision-making, to undertake government-assigned projects with regard to key S&T problems in the process of socio-economic development, to initiate personnel training, and to promote China's high-tech enterprises through its active engagement in these areas.

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

In this book we explore new approaches to understanding the physical and chemical properties of emergent complex functional materials, revealing a close relationship between their structures and properties at the molecular level. The primary focus of this book is on the ability to synthesize materials with a controlled chemical composition, a crystallographic structure, and a well-defined morphology. Special attention is also given to the interplay of theory, simulation and experimental results, in order to interconnect theoretical knowledge and experimental approaches, which can reveal new scientific and technological directions in several fields, expanding the versatility to yield a variety of new complex materials with desirable applications and functions. Some of the challenges and opportunities in this field are also discussed, targeting the development of new emergent complex functional materials with tailored properties to solve problems related to renewable energy, health, and environmental sustainability. A more fundamental understanding of the physical and chemical properties of new emergent complex functional materials is essential to achieving more substantial progress in a number of technological fields. With this goal in mind, the editors invited acknowledged specialists to contribute chapters covering a broad range of disciplines.

Now in its 43rd volume, the Specialist Periodical Report in Nuclear Magnetic Resonance presents comprehensive and critical reviews of the recent literature, providing the reader with an informed summary of the field from invited authors. Several chapters in this volume are devoted to biochemistry, focussing on carbohydrates, lipids, and proteins and nucleic acids; Malcolm Prior also presents a chapter examining the recent literature of NMR in living systems and Cynthia Jameson reviews the theoretical and physical aspects of nuclear shielding, while Jaroslaw Jazwinski examines the theoretical aspects of spin-spin couplings. The lead volume editor, Krystyna Kamienska-Trela, presents a chapter on the applications of spin-spin couplings. Anyone wishing to update themselves on the recent and hottest developments in NMR will benefit from this
volume, which deserves a place in any library or NMR facility. Purchasers of the print edition can register for free access to the electronic edition by returning the enclosed registration card.

This book is a comprehensive compilation of chapters on materials (both established and evolving) and material technologies that are important for aerospace systems. It considers aerospace materials in three Parts. Part I covers Metallic Materials (Mg, Al, Al-Li, Ti, aero steels, Ni, intermetallics, bronzes and Nb alloys); Part II deals with Composites (GLARE, PMCs, CMCs and Carbon based CMCs); and Part III considers Special Materials. This compilation has ensured that no important aerospace material system is ignored. Emphasis is laid in each chapter on the underlying scientific principles as well as basic and fundamental mechanisms leading to processing, characterization, property evaluation and applications. This book will be useful to students, researchers and professionals working in the domain of aerospace materials.

This three-volume set addresses a new knowledge of function materials, their processing, and their characterizations. "Functional and Smart Materials", covered the synthesis and fabrication route of functional and smart materials for universal applications such as material science, mechanical engineering, manufacturing, metrology, nanotechnology, physics, chemical, biology, chemistry, civil engineering, and food science. "Advanced Manufacturing and Processing Technology" covers the advanced manufacturing technologies includes coating, deposition, cladding, nanotechnology, surface finishing, precision machining, processing, and emerging advanced manufacturing technologies for processing of materials for functional applications. "Characterization, Testing, Measurement and Metrology" covered the application of new and advanced characterization techniques to investigate and analysis the processed materials.

Engineers and scientists alike will find this book to be an excellent introduction to the topic of porous materials, in particular the three main groups of porous materials: porous metals, porous ceramics, and polymer foams. Beginning with a general introduction to porous materials, the next six chapters focus on the processing and applications of each of the three main materials groups. The book includes such new processes as gel-casting and freeze-drying for porous ceramics and self-propagating high temperature synthesis (SHS) for porous metals. The applications discussed are relevant to a wide number of fields and industries, including aerospace, energy, transportation, construction, electronics, biomedical and others. The book concludes with a chapter on characterization methods for some basic parameters of porous materials. Porous Materials: Processing and Applications is an excellent resource for academic and industrial researchers in porous materials, as well as for upper-level undergraduate and graduate students in materials science and engineering, physics, chemistry, mechanics, metallurgy, and related specialties. A comprehensive overview of processing and applications of porous materials - provides younger researchers, engineers and students
Advanced Functional Solid Catalysts for Biomass Valorization presents the basic concepts in catalysis (homogeneous, heterogeneous, and enzymatic) and the properties of various kinds of heterogeneous solid catalysts, including their structure, porosity, particle size, BET surface area, acid-base, and redox properties. Useful information about biorefineries, types of biomass feedstocks, their structures and properties as well as about several potential catalytic routes for biomass upgrading to useful fuels and chemicals is provided in this book. Importantly, this book covers the most recent developments toward functionalization of various solid catalysts, optimization of catalysts’ properties, developing cascade catalytic strategies, exploring reaction kinetics/mechanisms, and evaluating catalysts’ stability/reusability during biomass upgrading. Current challenges and opportunities for the future biorefineries as well as for the design of advanced functional solid catalysts are critically discussed. Describes catalysis as a promising technology for the development of eco-friendly and economically viable strategies for several important energy and environmental applications. Covers heterogeneous solid catalysts because of their versatile benefits in terms of catalysts’ synthesis, production cost, stability, and reusability as compared to homogeneous liquid catalysts. Provides promising strategies for the design of new catalytic materials, such as carbon materials, metal–organic frameworks, zeolites, and mesoporous silicas. Describes functional solid catalysts for developing one-pot cascade processes for efficient biomass valorization and other vital chemical transformations.

3D and 4D Printing of Polymer Nanocomposite Materials: Processing, Applications, and Challenges covers advanced 3D and 4D printing processes and the latest developments in novel polymer-based printing materials, thus enabling the reader to understand and benefit from the advantages of this groundbreaking technology. The book presents processes, materials selection, and printability issues, along with sections on the preparation of polymer composite materials for 3D and 4D printing. Across the book, advanced printing techniques are covered and discussed thoroughly, including fused deposition modeling (FDM), selective laser sintering (SLS), selective laser melting (SLM), electron beam melting (EBM), inkjet 3D printing (3DP), stereolithography (SLA), and 3D plotting. Finally, major applications areas are discussed, including electronic, aerospace, construction and biomedical applications, with detailed information on the design, fabrication and processing methods required in each case. Provides a thorough, clear understanding of polymer preparation techniques and 3D and 4D printing processes, with a view to specific applications Examines synthesis, formation methodology, the dispersion of fillers, characterization, properties, and performance of polymer nanocomposites Explores the possibilities of 4D printing,
covering the usage of stimuli responsive hydrogels and shape memory polymers

This volume contains papers which were submitted at the International Conference on Advanced Materials, Processing and Testing Technology (AMPTT 2019, May 17-18, 2019, Guangzhou, China) and presents to readers research results in the area of modern materials and materials processing technologies. We hope this collection will be useful for many researchers and engineers from the various branches of modern industry and construction.

Energy is a key world issue in the context of climate change and increasing population, calling for alternative fuels, better energy storage, and energy-saving devices. This book reviews the principles and applications of metals and metal oxides for energy, with focus on batteries, electrodes, nanomaterials, electronics, supercapacitors, biofuels and sensors.

Functional Materials have assumed a very prominent position in several high tech areas. Such materials are not being classified on the basis of their origin, nature of bonding or processing techniques but are classified on the basis of the functions which they can perform. This is a significant departure from the earlier schemes in which materials were described as metals, alloys, ceramics, polymers, glass materials etc. Several new processing techniques have also evolved in the recent past. Because of the diversity of materials and their functions it has become extremely difficult to obtain information from single source. Functional Materials: Preparation, Processing and Applications provides a comprehensive review of the latest developments. Serves as a ready reference for Chemistry, Physics and Materials Science researchers by covering a wide range of functional materials in one book Aids in the design of new materials by emphasizing structure or microstructure - property correlation Covers the processing of functional materials in detail which helps in conceptualizing the applications of them

Nano Design for Smart Gels addresses the formation and application of technological gels and how nanostructural prospects are fundamental to gelling. Topics focus on the classification of gels based on small molecules and polymer gellers, biogels, stimulation conditions, topological, thermodynamic and kinetic aspects and characterization techniques. The book outlines structure and characterization concepts in order to provide pragmatic tools for the design and tailoring of new functional gel architectures. It provides an important source for readers and researchers who are currently or may soon be in research with gels, presenting an overview of fundamental topics. Highlights the building-blocks that make up the main functional groups that result in gelator compounds Provides an accessible source to the most common responses of gels, classified in their functional groups Outlines major characterization techniques, showing how they can be combined
Over the last few decades magnetism has seen an enormous expansion into a variety of different areas of research, notably the magnetism of several classes of novel materials that share with truly ferromagnetic materials only the presence of magnetic moments. Volume 23 of the Handbook of Magnetic Materials, like the preceding volumes, has a dual purpose. With contributions from leading authorities in the field, it includes a variety of self-contained introductions to a given area in the field of magnetism without requiring recourse to the published literature. It is also a reference for scientists active in magnetism research, providing readers with novel trends and achievements in magnetism. In each of these articles an extensive description is given in graphical as well as in tabular form, with much emphasis being placed on the discussion of the experimental material within the framework of physics, chemistry and material science. Comprises topical review articles written by leading authorities Introduces given topics in the field of magnetism Describes novel trends and achievements in magnetism

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