Magnetic Nanoparticles Properties Synthesis And Applications Physics Research And Technology

Magnetic nanomaterials have undergone a significant evolution during the past decade, with supramolecular nanoparticle organization reaching unprecedented levels of complexity and the materials providing new approaches to treating cancer. Magnetic Nanomaterials will provide a comprehensive overview of the latest research in the area of magnetic nanoparticles and their broad applications in synthesis, catalysis and theranostics. The book starts with an introduction to magnetism in nanomaterials and magnetic nanoparticle design followed by individual chapters which focus on specific uses. Applications covered include drug delivery, theranostic agents for cancer treatment as well as catalysis, biomass conversion and catalytic enhancement of NMR sensitivity. The reader will have the opportunity to learn about the frontier of magnetic nanotechnology from scientists that have shaped this unique and highly collaborative field of research. Written and edited by experts working within the field across the world, this book will appeal to students and researched interested in nanotechnology, engineering and physical sciences.

This interdisciplinary approach to the topic brings together reviews of the physics, chemistry, fabrication and application of magnetic nanoparticles and nanostructures within a single cover. With its discussion of the basics as well as the most recent developments, and featuring many examples of practical applications, the result is both a clear and concise introduction to the topic for beginners and a guide to relevant comprehensive physical phenomena and essential technological applications for experienced researchers.

Magnetic Nanoparticles for Medical Diagnostics was written to encourage members of the medical profession to join experts from other fields of research in exploring the unique physical properties of magnetic nanoparticles for medical applications. It demonstrates the evolution from small groups of scientists fabricating magnetic sensors to multidisciplinary research on wide-ranging medical applications of magnetic nanoparticles, illustrating the regenerative and dynamic nature of this area of research. The book covers the following topics: Magnetic probe and magnetic nanoparticles for sentinel lymph node biopsy, Magnetic separation of endosomes, exosomes, mitochondria and autophagosomes using magnetic beads, New affinity 200 nm diameter nanobead technology and target isolation of bioactive compounds, Fluorescent magnetic beads for medical diagnostics including rapid detection of prostate cancer biomarker PSA, Medical applications of functional viral capsid-coated artificial beads, including magnetic nanoparticles, Magnetic hyperthermia using implant type heating mediators, Synthesis, dispersion and application of stable magnetic colloids including MRI contrast agents and drug delivery, Optical and magnetic detection of fluorescent magnetic beads for medical diagnostics for point-of-care testing Book jacket.

Offering the latest information in magnetic nanoparticle (MNP) research, this book builds upon the success of the first volume and provides an updated and comprehensive review, from synthesis, characterization, and biofunctionalization to clinical applications of MNPs, including the diagnosis and treatment of cancers. The book captures some of emerging research area which was not available in the first

volume. Good Manufacturing Practices and Commercialization of MNPs are also included. This volume, also written by some of the most qualified experts in the field, incorporates new developments in the literature, and continues to bridge the gaps between the different areas in this field.

The book Biomaterials in Regenerative Medicine is addressed to the engineers and mainly medical practitioners as well as scientists and PhD degree students. The book indicates the progress in research and in the implementation of the ever-new biomaterials for the application of the advanced types of prosthesis, implants, scaffolds and implant-scaffolds including personalised ones. The book presents a theoretical approach to the synergy of technical, biological and medical sciences concerning materials and technologies used for medical and dental implantable devices and on metallic biomaterials. The essential contents of the book are 16 case studies provided in each of the chapters, comprehensively describing the authors' accomplishments of numerous teams from different countries across the world in advanced research areas relating to the biomaterials applied in regenerative medicine and dentistry. The detailed information collected in the book, mainly deriving from own and original research and R

Magnetic spinels including ferrites are insulating magnetic oxides and chalcogenides with strong coupling to microwave frequencies and low eddy current losses making them indispensable for applications in wireless communications. The 13 chapters and preface of this book discuss other potential applications of magnetic spinels along with various methods used for their synthesis and their varied properties resulting from substituting different metal ions at the A and B sites. These applications include ferrofluids, anticorrosion coatings, absorber coatings for photothermal conversion, biomedicine, and environmental applications such as oxidation of volatile organic compounds and removal of arsenic and heavy metals from water. Emphasis is placed on structure-property correlations and on the nature of magnetism in spinels and their nanoparticles with current information provided for future research.

This contribution book collects reviews and original articles from eminent experts working in the interdisciplinary arena of novel drug delivery systems and their uses. From their direct and recent experience, the readers can achieve a wide vision on the new and ongoing potentialities of different drug delivery systems. Since the advent of analytical techniques and capabilities to measure particle sizes in nanometer ranges, there has been tremendous interest in the use of nanoparticles for more efficient methods of drug delivery. On the other hand, this reference discusses advances in the design, optimization, and adaptation of gene delivery systems for the treatment of cancer, cardiovascular, pulmonary, genetic, and infectious diseases, and considers assessment and review procedures involved in the development of gene-based pharmaceuticals.

This book brings together in one, compact volume all aspects of the available information about the iron oxides. It presents a coherent, up to date account of the properties, reactions and mechanisms of formation of these compounds. In addition, there are chapters dealing with iron oxides in rocks and soils, as biominerals and as corrosion products together with methods of synthesis and the numerous application of these compounds. Their role in the environment is also discussed. The authors are experts in the field of iron oxides and have worked on all the topics covered. Much recent data from the authors' own laboratories is included and opportunities for further

research are indicated. Special features are the electron micrographs and colour plates together with the many different spectra used to illustrate properties and aspects of behaviour. Numerous tables and graphs enable trends and relationships to be seen at a glance. The book concludes with an extensive bibliography. This book should prove invaluable to industry and to all researchers who, whatever their background and level of experience, are interested in this rapidly expanding field. It is an essential volume for any scientific library and is now in its second, completely revised and extended edition!

This book summarizes recent progress due to novel functionalized magnetic nanoparticles in the analytical chemistry arena and addresses the challenges for their use in that area.

Suspensions of both dispersed and clustered iron oxide nanoparticles are of interest for biomedical applications as diagnostic and therapeutic agents due to their bio-compatibility and interesting magnetic and magnetic resonance properties. Their application is critically dependent on the fact that these properties are highly size-dependant. By developing NP synthesis and assembly methods, to provide improved size control at the two levels of organisation, NP suspensions with controlled emergent magnetic properties have been prepared. The first part of this thesis presents the size-controlled synthesis of magnetic nanoparticles whose surface is functionalised with a wide range of stabilising ligands. An investigation was undertaken to elucidate the effect of the stabilising ligands on the physical properties. The second part of the thesis presents a novel method for the reproducible assembly, in suspension, of NPs to form clusters. The method can be used to produce clusters of controlled size in large quantities; it is also shown that the kinetics of assembly can be easily controlled and that this influences the emergent magnetic properties. Arising from this observation a study was undertaken to determine the role of cluster architecture on the magnetic resonance properties of their aqueous suspensions.

This brief offers a comprehensive discussion of magnetic targeted drug delivery of silica-coated nanodevices. Focusing on the latest trend in pharmaceutical applications of these nanodevices, a multidisciplinary overview is displayed, from synthesis and design to pharmacokenetics, biodistribution and toxicology. Chapters include design of silica-coated magnetic nanodevices; techniques for drug loading with features applicable to biological systems; synthesis, characterization and the assessment of biomedical issues with both in vitro and in vivo experiments. Applications in the treatment of different localized diseases are also addressed in order to present the potential use of these nanosystems as global, commercially available therapeutics.

Drawing together topics from a wide range of disciplines, this text provides a comprehensive insight into the fundamentals of magnetic biosensors and the applications of magnetic nanoparticles in medicine. Internationally renowned researchers showcase topics ranging from the basic physical principles of magnetism to the detection and manipulation, synthesis protocols and natural occurrence of magnetic nanoparticles. Up-to-date examples of their clinical

usage and research applications in the biomedical fields of sensing by diverse magnetic detection methods, in imaging by MRI and in therapeutic strategies such as hyperthermia, are also discussed, providing a thorough introduction to this rapidly developing field. Each chapter features questions with answers, highlighted definition boxes, and numerous illustrations which help readers grasp key concepts. Mathematical tools, together with key literature references, provide a strong underpinning for the material, making it ideal for graduate students, lecturers, medical researchers and industrial scientific strategists.

Surface engineering can be defined as an enabling technology used in a wide range of industrial activities. Surface engineering was founded by detecting surface features which destroy most of pieces, e.g. abrasion, corrosion, fatigue, and disruption; then it was recognized, more than ever, that most technological advancements are constrained with surface requirements. In a wide range of industry (such as gas and oil exploitation, mining, and manufacturing), the surfaces generate an important problem in technological advancement. Passing time shows us new interesting methods in surface engineering. These methods usually apply to enhance the surface properties, e.g. wear rate, fatigue, abrasion, and corrosion resistance. This book collects some of new methods in surface engineering.

Nanomaterials are important tools for enabling technological progress as they can provide dramatically different properties as compared to the bulk counterparts. The field of nanoparticles is one of the most investigated within nanomaterials, thanks to the existing, relatively simple, means of manufacturing. In this thesis, high-power pulsed hollow cathode sputtering is used to nucleate and grow magnetic nanoparticles in a plasma. This sputtering technique provides a high degree of ionization of the sputtered material, which has previously been shown to aid in the growth of the nanoparticles. The magnetic properties of the particles are utilized and makes it possible for the grown particles to act as building blocks for self-assembly into more sophisticated nano structures, particularly when an external magnetic field is applied. These structures created are termed “nanowires” or “nanotrusses”, depending on the level of branching and inter-linking that occurs. Several different elements have been investigated in this thesis. In a novel approach, it is shown how nanoparticles with more advanced structures, and containing material from two hollow cathodes, can be fabricated using high-power pulses. The dual-element particles are achieved by using two distinct and individual elemental cathodes, and a pulse process that allows tuning of individual pulses separately to them. Nanoparticles grown and investigated are Fe, Ni, Pt, Fe-Ni and Ni-Pt. Alternatively, the addition of oxygen to the process allows the formation of oxide or hybrid metal oxide – metal particles. For all nanoparticles containing several elements, it is demonstrated that the stoichiometry can be easily varied, either by the amount of reactive gas let into the process or by tuning the amount of sputtered material through adjusting the electric power supplied to the different cathodes. One aim of the

presented work is to find a suitable material for the use as a catalyst in the production of H2 gas through the process of water splitting. H2 is a good candidate to replace fossil fuels as an energy carrier. However, rare elements (such as Ir or Pt) needs to be used as the catalyst, otherwise a high overpotential is required for the splitting to occur, leading to a low efficiency. This work demonstrates a possible route to avoid this, by using nanomaterials to increase the surface-to-volume ratio, as well as optimizing the elemental ratio between different materials to lower the amount of noble elements required.

Iron Oxide Nanoparticles for Biomedical Applications: Synthesis, Functionalization and Application begins with several chapters covering the synthesis, stabilization, physico-chemical characterization and functionalization of iron oxide nanoparticles. The second part of the book outlines the various biomedical imaging applications that currently take advantage of the magnetic properties of iron oxide nanoparticles. Brief attention is given to potential iron oxide based therapies, while the final chapter covers nanocytotoxicity, which is a key concern wherever exposure to nanomaterials might occur. This comprehensive book is an essential reference for all those academics and professionals who require thorough knowledge of recent and future developments in the role of iron oxide nanoparticles in biomedicine. Unlocks the potential of iron oxide nanoparticles to transform diagnostic imaging techniques Contains full coverage of new developments and recent research, making this essential reading for researchers and engineers alike Explains the synthesis, processing and characterization of iron oxide nanoparticles with a view to their use in biomedicine

Nanomaterials for Magnetic and Optical Hyperthermia Applications focuses on the design, fabrication and characterization of nanomaterials (magnetic, gold and hybrid magnetic-gold nanoparticles) for in vitro and in vivo hyperthermia applications, both as standalone and adjuvant therapy in combination with chemotherapy. The book explores the potential for more effective cancer therapy solutions through the synergistic use of nanostructured materials as magnetic and optical hyperthermia agents and targeted drug delivery vehicles, while also discussing the challenges related to their toxicity, regulatory and translational aspects. In particular, the book focuses on the design, synthesis, biofunctionalization and characterization of nanomaterials employed for magnetic and optical hyperthermia. This book will be an important reference resource for scientists working in the areas of biomaterials and biomedicine seeking to learn about the potential of nanomaterials to provide hyperthermia solutions. Explores the design of efficient nanomaterials for hyperthermia applications, allowing readers to make informed materials selection decisions Discusses the biofunctionalization of a range of nanomaterials and their interaction with living systems Provides an overview of the current clinical applications of nanomaterials in hyperthermia treatment

Magnetic nanoparticles (MNPs) are one of the materials of great interest for

presenting a unique combination of relevant properties such as high surface area, magnetic behavior and low toxicity, which can find potential use in different processes and applications in areas such as catalysis, data storage, water treatment, drug delivery system, DNA separation, tissue engineering, sensors, hyperthermia, ferrofluids, and as contrast agents in nuclear magnetic resonance (NMR) imaging. This book provides further information on how magnetic nanoparticles are synthesized, their physicochemical properties and the roles MNPs play in biomedicine. (Imprint: Nova)

Recently, magnetic nanostructures have gained a remarkable interest for basic research and applied studies. Because of their low cost and ease of manufacture and modification, they have great potential for agricultural and environmental applications. The use of magnetic nanostructures has been proven in a wide range of fields including catalysis, biotechnology, biomedicine, magnetic resonance imaging, agriculture, biosensors, and removal of environmental pollutants, among others. This book includes 16 chapters of collected knowledge, discoveries, and applications in agriculture, soil remediation, and water treatment. It describes the role of nano-agriculture with regard to food security and discusses environmental and agricultural protection concerns. It further offers potential applications of magnetic nanomaterials in the agriculture and food sectors, such as the development of sensors, environment monitoring for wastewater treatment and the remediation of contaminated soils. Increasing crop yield through the use of nanopesticides or nanofertilizers and biosecurity using sensors for detecting pathogens along the entire food chain are discussed as well. This book also brings together various sources of expertise on different aspects magnetic nanostructure application in the agri-food sector and environment remediation. Magnetic nanostructures also have great potential in biotechnological processes, as they can be utilized as a carrier for enzymes during different biocatalytic transformations. Novel magnetic nanomaterials can be used for detection and separation of pesticides from environmental and biological samples. The excellent adsorption capacity of the modified magnetic nanoadsorbents together with other advantages such as reusability, easy separation, environmentally friendly composition, and freedom of interferences of alkaline earth metal ions make them suitable adsorbents for removal of heavy metal ions from environmental and industrial wastes. One of the most important environmental applications of magnetic nanostructures has been in the treatment of water, whether in the remediation of groundwater or through the magnetic separation and/or sensing of contaminants present in various aqueous systems. The integrated combination of these 16 chapters, written by experts with considerable experience in their area of research, provides a comprehensive overview on the synthesis, characterization, application, environmental processing, and agriculture of engineered magnetic nanostructures. Its comprehensive coverage discusses how nanostructure materials interact in plants as well as their potential and useful applications.

Magnetic nanoparticles appear naturally in rock magnetism together with a large distribution of sizes and shapes. They have numerous applications from nano-size magnetic memories to metamaterials for electromagnetic waves as well as biological applications such as nanosurgery with minimal traumatism. Their long-ranged size- and shape-dependent dipolar interactions provide numerous useful properties. This book describes the preparation as well as the magnetic properties of nanoparticles and also considers 2D dots, nearly spherical samples, elongated samples, and various assemblies of nanoparticles. The authors report the static magnetic structures and dynamic properties of these nanoparticles and the topological defects in 2D and 3D nanoparticles with new examples of S-shaped vortex or antivortex and of bent vortex or antivortex in 3D nanoparticles. The spectrum of magnetic excitations is shown to exhibit the occurrence of gaps, a key for magnonic metamaterial devices. Magnetic excited states are also considered with their coupling to nanoparticle elastic properties.

Magnetic nanoparticles have been attracting much interest in the fields of advanced biological and medical applications such as drug delivery, magnetic resonance imaging, and array-based assaying as well as in the fields of separation science. This book presents current research in the study of the properties, synthesis and applications of magnetic nanoparticles. Topics include the synthesis of organic based magnetic nanoparticles-polymers and calixarene based magnetic nanoparticles; ferromagnetism in carbon and boron nitride nanostructures; and computer simulations, chemical syntheses and biomedical diagnosis using magnetic nanoparticles.

The ever-increasing desire for more energy attainable from a smaller volume of matter has driven researchers to explore advanced materials at the molecular size. Magnetic materials at the nanometer size scale have been the subject of enormous research effort worldwide for more than half a century. Different magnetic nanoparticles have shown different behavior in the absence and presence of an external magnetic field, which has led them to be categorized as soft or hard magnets. Applications range from medical and biomedical devices to magnetic recording media and magnetic sensing have emphasized the importance of this class of materials. Soft magnetic phases have found application in power generation and magnetic targeted drug delivery, while hard magnets have been subject of extensive research for application as energy storage media. Discovery of the exchange-coupling phenomenon between two adjacent hard and soft magnetic phases has attracted scientists to develop advanced materials for energy storage with no usage of fossil fuels: clean energy. In this Dissertation, synthesis of pure phase, soft FeCo nanoparticles with high magnetic moment and hard phase CoxC nanoparticles possessing high coercivity is reported. The polyol method (chemical co-precipitating at polyhydric alcohol as reducing agent) is used to make FeCo and CoxC nanoparticles and the effects of important reaction kinetics parameters on the structure and magnetic properties of the products are studied. Careful analysis of correlations

between these parameters and the properties of the magnetic particles has made synthesis of FeCo and CoxC nanoparticles with desired properties possible. Fabrication of MnAlC-FeCo heterostructures as a rare earth-free alternative for high-performance permanent magnet is also reported. To synthesize MnAlC-FeCo, mechanical alloying and dry mixing of MnAlC and FeCo nanoparticles are accomplished followed by annealing in a furnace. Overall, the achieved results in this work enable synthesis of high moment FeCo and high coercivity CoxC with desired structure and magnetic properties obtained through polyol method. In particular, this Dissertation provides the technique to fabricate cobalt carbide nanoparticles without using rare earth elements as a catalyst or as heterogeneous seed nuclei at any stage of the processing.

Ionic liquids, including the newer subcategory of deep eutectic solvents, continue to attract a great deal of research attention in an even increasing number of areas, including traditional areas such as synthesis (organic and materials), electrochemistry, and physical property studies and predictions, as well as less obvious areas such as lubrication and enzymatic transformations. In this volume, recent advances in a number of these different areas are reported and reviewed, thus granting some appreciation for the future that ionic liquid research holds and affording inspiration for those who have not previously considered the application of ionic liquids in their area of interest.

Magnetic Nanostructured Materials: From Lab to Fab presents a complete overview of the translation of nanostructured materials into realistic applications, drawing on the most recent research in the field to discuss the fundamentals, synthesis and characterization of nanomagnetics. A wide spectrum of nanomagnetic applications is included, covering industrial, environmental and biomedical fields, and using chemical, physical and biological methods. Materials such as Fe, Co, CoxC, MnGa, GdSi, ferrite nanoparticles and thin films are highlighted, with their potential applications discussed, such as magnetic refrigeration, energy harvesting, magnetic sensors, hyperthermia, MRI, drug delivery, permanent magnets, and data storage devices. Offering interdisciplinary knowledge on the materials science of nanostructured materials and magnetics, this book will be of interest to researchers in materials science, engineering, physics and chemistry with interest in magnetic nanomaterials, as well as postgraduate students and professionals in industry and government. Provides interdisciplinary knowledge on the materials science of nanostructured materials and magnetics Aids in the understanding of complex fundamentals and synthesis methods for magnetic nanomaterials Includes examples of real applications Shows how laboratory work on magnetic nanoparticles connects to industrial implementation and applications

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Magnetic nanowires and microwires are key tools in the development of enhanced devices for information technology (memory and data processing) and sensing. Offering

the combined characteristics of high density, high speed, and non-volatility, they facilitate reliable control of the motion of magnetic domain walls; a key requirement for the development of novel classes of logic and storage devices. Part One introduces the design and synthesis of magnetic nanowires and microwires, reviewing the growth and processing of nanowires and nanowire heterostructures using such methods as sol-gel and electrodeposition combinations, focused-electron/ion-beam-induced deposition, chemical vapour transport, quenching and drawing and magnetic interactions. Magnetic and transport properties, alongside domain walls, in nano- and microwires are then explored in Part Two, before Part Three goes on to explore a wide range of applications for magnetic nano- and microwire devices, including memory, microwave and electrochemical applications, in addition to thermal spin polarization and configuration, magnetocalorific effects and Bloch point dynamics. Detailed coverage of multiple key techniques for the growth and processing of nanowires and microwires Reviews the principles and difficulties involved in applying magnetic nano- and microwires to a wide range of applications Combines the expertise of specialists from around the globe to give a broad overview of current and future trends

Novel Magnetic Nanostructures: Unique Properties and Applications reviews the synthesis, design, characterization and unique properties of emerging nanostructured magnetic materials. It discusses the most promising and relevant applications, including data storage, spintronics and biomedical applications. Properties investigated include electronic, self-assembling, multifunctional, and magnetic properties, along with magnetic phenomena. Structures range from magnetic nanoclusters, nanoparticles, and nanowires, to multilayers and self-assembling nanosystems. This book provides a better understanding of the static and dynamic magnetism in new nanostructures for important applications. Provides an overview of the latest research on novel magnetic nanostructures, including molecular nanomagnets, metallacrown magnetic nanostructures, magnetic dendrimers, self-assembling magnetic structures, multifunctional nanostructures, and much more Reviews the synthesis, design, characterization and detection of useful properties in new magnetic nanostructures Highlights the most relevant applications, including spintronic, data storage and biomedical applications

Biomedical Applications of Magnetic Particles discusses fundamental magnetic nanoparticle physics and chemistry and explores important biomedical applications and future challenges. The first section presents the fundamentals of the field by explaining the theory of magnetism, describing techniques to synthesize magnetic particles, detailing methods to characterize magnetic particles, and quantitatively describing the applied magnetic forces, torques, and the resultant particle motions. The second section describes the wide range of biomedical applications, including chemical sensors, cellular actuators, drug delivery, magnetic hyperthermia, magnetic resonance imaging contrast enhancement, and toxicity. Additional key features include: Covers both introduction to physics and characterization of magnetic nanoparticles and the state of the art in biomedical applications Authoritative reference for scientists and engineers for all new or old to the field Describes how the size of magnetic nanoparticles affects their magnetic properties, colloidal properties, and biological properties. Written by a team of internationally respected experts, this book provides an up-to-date authoritative reference for scientists and engineers.

Offering the latest information in magnetic nanoparticle (MNP) research, Magnetic Nanoparticles: From Fabrication to Clinical Applications provides a comprehensive review, from synthesis, characterization, and biofunctionalization to clinical applications of MNPs, including the diagnosis and treatment of cancers. This book, written by some of the most qualified experts in the field, not only fills a hole in the literature, but also bridges the gaps between all the different areas in this field. Translational research on tailored magnetic nanoparticles for biomedical applications spans a variety of disciplines, and putting together the most significant advances into a practical format is a challenging task. Balancing clinical applications with the underlying theory and foundational science behind these new discoveries, Magnetic Nanoparticles: From Fabrication to Clinical Applications supplies a toolbox of solutions and ideas for scientists in the field and for young researchers interested in magnetic nanoparticles.
Timely and comprehensive, this book presents recent advances in magnetic nanomaterials research, covering the latest developments, including the design and preparation of magnetic nanoparticles, their physical and chemical properties as well as their applications in different fields, including biomedicine, magnetic energy storage, wave-absorbing and water remediation. By allowing researchers to get to the forefront developments related to magnetic nanomaterials in various disciplines, this is invaluable reading for the nano, magnetic, energy, medical, and environmental communities.
Environmental analysis techniques have advanced due to the use of nanotechnologies in improving the detection sensitivity and miniaturization of the devices in analytical procedures. These allow for developments such as increases in analyte concentration, the removal of interfering species and improvements in the detection limits. Bridging a gap in the literature, this book uniquely brings together state-of-the-art research in the applications of novel nanomaterials to each of the classical components of environmental analysis, namely sample preparation and extraction, separation and identification by spectroscopic techniques. Special attention is paid to those approaches that are considered greener and reduce the cost of the analysis process both in terms of chemicals and time consumption. Advanced undergraduates, graduates and researchers at the forefront of environmental science and engineering will find this book a good source of information. It will also help regulators, decision makers, surveillance agencies and the organizations assessing the impact of pollutants on the environment.
Magnetic Nanoparticle-Based Hybrid Materials: Fundamentals and Applications introduces the principles, properties, and emerging applications of this important materials system. The hybridization of magnetic nanoparticles with metals, metal oxides and semiconducting nanoparticles may result in superior properties. The book reviews the most relevant hybrid materials, their mechanisms and properties. Then, the book focuses on the rational design, controlled synthesis, advanced characterizations and in-depth understanding of structure-property relationships. The last part addresses the promising applications of hybrid nanomaterials in the real world such as in the environment, energy, medicine fields. Magnetic Nanoparticle-Based Hybrid Materials: Fundamentals and Applications comprehensively reviews both the theoretical and experimental approaches used to rapidly advance nanomaterials that could result in new technologies that impact day-to-day life and society in key areas such as health

and the environment. It is suitable for researchers and practitioners who are materials scientists and engineers, chemists or physicists in academia and R&D. Provides in-depth information on the basic principles of magnetic nanoparticles-based hybrid materials such as synthesis, characterization, properties, and magnon interactions Discusses the most relevant hybrid materials systems including integration of metals, metal oxides, polymers, carbon and more Addresses the emerging applications in medicine, the environment, energy, sensing, and computing enabled by magnetic nanoparticles-based hybrid materials

This book describes the different methodologies for producing and synthesizing silver nanoparticles (AgNPs) of various shapes and sizes. It also provides an in-depth understanding of the new methods for characterizing and modifying the properties of AgNPs as well as their properties and applications in various fields. This book is a useful resource for a wide range of readers, including scientists, engineers, doctoral and postdoctoral fellows, and scientific professionals working in specialized fields such as medicine, nanotechnology, spectroscopy, analytical chemistry diagnostics, and plasmonics.

The integration of top-down lithographic techniques with synthetic organic and inorganic technologies is a key challenge for the development of effective nanosca1e devices. In terms of assembly, nanoparticles provide an excellent tool for bridging the gap between the resolution of electron beam lithography (-60 nm) and the molecular level. Nanoparticles possess an array of unique properties associated with their core materials, including distinctive magnetic, photonic and electronic behavior. This behavior can be controlled and applied through monolayer functionalization and assembly strategies, making nanoparticles both scaffolds and building blocks for nanotechnology. The diverse structures and properties of nanoparticles makes them useful tools for both fundamental studies and pragmatic applications in a range of disciplines. This volume is intended to provide an integrated overview of the synthesis and assembly of nanoparticles, and their applications in chemistry, biology, and materials science. The first three chapters focus on the creation and intrinsic properties of nanoparticles, covering some of the myriad core materials and shapes that have been created. The remaining chapters of the book discuss the assembly of nanoparticles, and applications of both discrete particles and particle assemblies in a wide range of fields, including device and sensor fabrication, catalysis, biology, and nanosca1e electronic and magnetic systems.

Nanotechnology is the application of science to control matter at the molecular level. It has become one of the most promising applied technologies in all areas of science. Nanoparticles have multi-functional properties and have created very interesting applications in various fields such as medicine, nutrition, bioenergy, agriculture and the environment. But the biogenic syntheses of monodispersed nanoparticles with specific sizes and shapes have been a challenge in biomaterial science. Nanoparticles are of great interest due to their extremely small size and large surface-to-volume ratio, which lead to both chemical and physical differences in their properties (e.g., mechanical properties, biological and sterical properties, catalytic activity, thermal and electrical conductivity, optical absorption and melting point) compared to bulk of the same chemical composition. Recently, however, synthesizing metal nanoparticles using green technology via microorganisms, plants, viruses, and so on, has been extensively studied and has become recognized as a green and efficient way for further exploiting biological systems as convenient nanofactories. Thus the biological synthesis of nanoparticles is increasingly regarded as a rapid, ecofriendly, and easily scaled-up technology. Today researchers are developing new techniques and materials using nanotechnology that may be suitable for plants to boost their native functions. Recently, biological nanoparticles

were found to be more pharmacologically active than physico-chemically synthesized nanoparticles. Various applications of biosynthesized nanoparticles have been discovered, especially in the field of biomedical research, such as applications to specific delivery of drugs, use for tumor detection, angiogenesis, genetic disease and genetic disorder diagnosis, photoimaging, and photothermal therapy. Further, iron oxide nanoparticles have been applied to cancer therapy, hyperthermia, drug delivery, tissue repair, cell labeling, targeting and immunoassays, detoxification of biological fluids, magnetic resonance imaging, and magnetically responsive drug delivery therapy. Nanoparticle synthesis for plant byproducts for biomedical applications has vast potential. This book offers researchers in plant science and biomedicine the latest research and opportunity to develop new tools for the synthesis of environmentally friendly and cost-effective nanoparticles for applications in biomedicine as well as other various fields.

"Nanomaterials" is a special topic of recent research and is a milestone of nanoscience and nanotechnology. Nanoscale materials are a series of substances/compounds, in which at least one dimension has smaller size than 100 nm. Nanomaterials have a broad area of development, which is growing rapidly day by day. Their impact on commercial applications as well as on the respective academia and education is huge. The basic points of this book can be divided into synthesis of nanomaterials and their applications. For example, special mention is about metal-oxide nanostructures, nanocomposites, and polymeric nanomaterials. Also, synthesis, characterizations, various processes, fabrications and some promising applications are also developed and analyzed.

Micro-Facts has proved to be a useful ready reference for practising food microbiologists and others concerned with ensuring the microbiological safety of foods. Micro-Facts 6th Edition is an invaluable tool for food microbiologists everywhere, as a source book of information relevant to the prevention of food-poisoning hazards worldwide.

The first book offering a global overview of fundamental microfluidics and the wide range of possible applications, for example, in chemistry, biology, and biomedical science. As such, it summarizes recent progress in microfluidics, including its origin and development, the theoretical fundamentals, and fabrication techniques for microfluidic devices. The book also comprehensively covers the fluid mechanics, physics and chemistry as well as applications in such different fields as detection and synthesis of inorganic and organic materials. A useful reference for non-specialists and a basic guideline for research scientists and technicians already active in this field or intending to work in microfluidics.

Nanomagnetic Materials: Fabrication, Characterization and Application explores recent studies of conventional nanomagnetic materials in spintronics, data storage, magnetic sensors and biomedical applications. In addition, the book also reviews novel magnetic characteristics induced in two-dimensional materials, diamonds, and those induced by the artificial formation of lattice defect and heterojunction as novel nanomagnetic materials. Nanomagnetic materials are usually based on d- and f-electron systems. They are an important solution to the demand for higher density of information storage, arising from the emergence of novel technologies required for non-volatile memory systems. Advances in the understanding of magnetization dynamics and in the characteristics of nanoparticles or surface of nanomagnetic materials is resulting in greater expansion of applications of nanomagnetic materials, including in biotechnology, sensor devices, energy harvesting, and power generating systems. This book provides a cogent overview of the latest research on novel nanomagnetic materials, including spintronic nanomagnets, molecular nanomagnets, self-assembling magnetic nanomaterials, nanoparticles, multifunctional materials, and heterojunction-induced novel magnetism. Explains manufacturing principles and process for nanomagnetic materials Discusses physical and chemical properties and potential industrial applications, such as magnetic data storage, sensors, oscillator, permanent magnets, power generations, and biomedical applications

Assesses the major challenges of using magnetic nanomaterials on a broad scale Nanoparticles for Biomedical Applications: Fundamental Concepts, Biological Interactions and Clinical Applications brings into one place information on the design and biomedical applications of different classes of nanoparticles. While aspects are dealt with in individual journal articles, there is not one source that covers this area comprehensively. This book fills this gap in the literature. Outlines an in-depth review of biomedical applications of a variety of nanoparticle classes Discusses the major techniques for designing nanoparticles for use in biomedicine Explores safety and regulatory aspects for the use of nanoparticles in biomedicine