Chapter 2 Mesoporous Silica Mcm 41 Si Mcm 41

The field of microporous solids in solid state chemistry has seen a huge expansion over the last decades with new developments in a diverse range of directions and applications. Drawing upon nature as an inspiration, scientists are continually extending known families and preparing porous solids with novel structures. In turn, the novel properties that these possess stimulate further research and applications. Microporous Framework Solids describes fundamental principles and experimental practices of the synthetic chemistry and physical characterisation of crystalline microporous solids. It also provides a clear and up to date discussion of different types of microporous materials, their applications and emerging areas of current interest, written from a personal research perspective. Topics include the different types of solids and their properties with key emphasis placed on the relationship between properties and structure. Structural methods are also discussed including the role of diffraction, NMR and computational studies. Finally, applications for catalysis are reviewed. This book is ideal for new researchers in the field of microporous solids both in academia and industry who require a detailed and informative overview of the subject. It provides a comprehensive review of microporous materials in an easily accessible style offering a valuable source of references over a wide range of topics.

Nowadays, microporous and mesoporous materials are versatile solids of great interest due to their structures and pore sizes, which allow their application in many areas. Accordingly, with IUPAC, materials with pore sizes smaller than 2 nm are called microporous and with pore sizes between 2 and 50 nm are called mesoporous. The pore size has an important impact on the material properties and affects their applications. In addition, high surface area, and their ability to incorporate functional groups on the framework are of great relevance for commercial and science applications. This book intends to provide readers with a comprehensive overview of recent improvements in the microporous and mesoporous materials field.

This thesis involves synthesis, derivatization and biomedical applications of mesoporous silica nanoparticles (MSNs) based delivery systems. Chapter 1 introduces the background of MSNs including the advantages of MSNs, modification on MSNs for multifunctionality; formation mechanism, a typical synthesis condition for MCM-41 and following characterizaitons. In chapter 2 & 3, the synthesis and application of target moiety functionalized MSNs for gene therapy in vitro and in vivo are introduced. Chapters 4, & 5 introduce the relevant studies of utilizing MSN based delivery system for the treatment of infectious disease, from a pharmacokinetic study of moxifloxacin delivered by MSNs via different routes, to the enhanced efficacy of MSN based treatment by materials optimizations via inhalation administration route. Chapter 6 discusses the study of a general synthesis method for pore enlargement in various types of MSNs. In Chapter 7, the design and preparation of a thin film consist of ultra large pore-sized mesoporous silica spheres and polymer template macropores is illustrated. Overall, these chapters demonstrate the successful engineering of mesoporous silica nanoparticles and materials optimization and their enhanced performance in biological applications from in vivo tumor shrinkage by gene delivery to antibiotics delivery for enhanced bacterial killing efficacy in mouse model.

Benzylidene Compounds—Advances in Research and Application: 2013 Edition is a ScholarlyEditions™ book that delivers timely, authoritative, and comprehensive information about Stilbenes. The editors have built Benzylidene Compounds—Advances in Research and Application: 2013 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Stilbenes in this book to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Benzylidene Compounds—Advances in Research and Application: 2013 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

This book is mainly based on the first and second symposia on Nanotechnology in Catalysis held in 2001 and 2002, but it also includes several contributions not presented in the symposia to round out the scope of the subject. The contents are the most up to date developments made by researchers all over the world in the catalysis field in this fascinating nanotechnology era. It reflects some of the frontier areas of nanoscience and nanotechnology in fabricating and characterizing catalysts and carrying out studies to prove their superior selectivity and activity. The field of application of nanotechnology for the development of catalysts for green chemistry is likely to grow rapidly during the next decade. This book hopes to contribute to the evolution of nanotechnology in that direction.

Epithelial Cells: Advances in Research and Application: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Epithelial Cells. The editors have built Epithelial Cells: Advances in Research and Application: 2011 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Epithelial Cells in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Epithelial Cells: Advances in Research and Application: 2011 Edition has been produced by the world's leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

Nanostructured materials with tailored properties are regarded as a fundamental element in the development of future science and technology. Research is still ongoing into the nanosized construction elements required to create functional solids. The recently developed technique, nanocasting, has great advantage over others in terms of the synthesis of special nanostructured materials by the careful choice of suitable elements and nanoengineering steps. This new book summarizes the recent developments in nanocasting, including the principles of nanocasting, syntheses of novel nanostructured materials, characterization methods, detailed synthetic recipes and further possible development in this area. The book focuses on the synthesis of porous solids from the viewpoint of methodology and introduces the science of nanocasting from fundamental principles to their use in synthesis of various materials. It starts by outlining the principles of nanocasting, requirements to the templates and precursors and the tools needed to probe matter at the nanoscale level. It describes how to synthesize nano structured porous solids with defined characteristics and finally discusses the functionalization and application of porous solids. Special attention is given to new developments in this field and future perspectives. A useful appendix covering the detailed synthetic recipes of various templates including porous silica, porous carbon and colloidal spheres is included which will be invaluable to researchers wanting to follow and reproduce nanocast materials. Topics covered in the book include: * inorganic chemistry * organic chemistry * solution chemistry * sol-gel and interface science * acid-base equilibria * electrochemistry * biochemistry * confined synthesis The book gives readers not only an overview of nanocasting technology, but also sufficient information and knowledge for those wanting to prepare various nanostructured materials without needing to search the available literature.

The development of catalysts is the most sophisticated art in chemical sciences. It can be read like a story book when the critical scientific contents are presented in a chronological manner with short and simple sentences. This book will meets these criteria. To address the sustainability issues of existing chemical manufacturing processes or producing new chemicals, researchers are developing alternate catalysts to eliminate toxic chemicals use and by-products formation. Sustainable Catalytic Processes presents critical discussions of the progress of such catalytic development. This book of contemporary research results in sustainable catalysis area will benefit scientists in both industries and academia, and students to learn recent catalysts/process development. Reports the most recent developments in catalysis

with a focus on environmentally friendly commercial processes, such as waste water treatment, alternate energy, etc Bridges the theory, necessary for the development of environmentally friendly processes, and their implementation through pilot plant and large scale Contains mainly laboratory scale data and encourages industrial scientists to test these processes on a pilot scale Includes work examples featuring the development of the new catalysts/processes using bio-renewable feedstock satisfactorily addressing environmental concerns Includes one chapter demonstrating real industrial examples motivating the industrial and academic researchers to pursue similar research

The development of a vector for the delivery of therapeutic drugs in a controlled and targeted fashion is still a major challenge in the treatment of many diseases. The conventional application of drugs may lead to many limitations including poor distribution, limited effectiveness, lack of selectivity and dose dependent toxicity. An efficient drug delivery system can address these problems. Recent nanotechnology advancements in the biomedical field have the potential to meet these challenges in developing drug delivery systems. Nanomaterials are changing the biomedical platform in terms of disease diagnosis, treatment and prevention. Nanomaterials aided drug delivery provides an advantage by enhancing aqueous solubility that leads to improved bioavailability, increased resistance time in the body, decreased side effects by targeting drugs to the specific location, reduced dose dependent toxicity and protection of drugs from early release. In this two-part book, the contributors have compiled reports of recent studies illustrating the promising nanomaterials that can work as drug carriers which can navigate conventional physiological barriers. A detailed account of several types of nanomaterials including polymeric nanoparticles, liposomes, dendrimers, micelles, carbon nanomaterials, magnetic nanoparticles, solid lipid-based nanoparticles, silica nanomaterials and hydrogels for drug delivery is provided in separate chapters. The contributors also present a discussion on clinical aspects of ongoing research with insights towards future prospects of specific nanotechnologies. Part II covers the following topics: · Solid lipid nanoparticles and nanostructured lipid carriers · Silica based nanomaterials · Hydrogels · Metallic nanoparticles · Computational and experimental binding interactions of drug and ?-cyclodextrin · Clinical milestones in nanotherapeutics · Drug delivery systems based on poly(lactide-co-glycolide) and its copolymers The book set is an informative resource for scholars who seek updates in nanomedicine with reference to nanomaterials used in drug delivery systems.

The present book "Zeolites and Related Materials: Trends, Targets and Challenges" reports the communications that have been presented at the 4th International FEZA (Federation of European Zeolite Associations) Conference in Paris, September 3-6, 2008. It gives an excellent overview of the present state of the art of ordered nanoporous solids including zeolites as well as synthetic layered materials (clays), nanosized molecular sieves, ordered mesoporous solids, metal-organic-framework compounds (MOFs), carbons, etc. with emphasis on the synthesis, comprehensive characterization and advanced applications. The significant research activities in this domain are due to the outstanding properties of those nanoporous materials that concentrate the collaborative efforts of researchers from material science, chemistry, physical chemistry and physics. The understanding and development of the unique properties of porous materials relies on a unique blend of multidisciplinary knowledge covering material science, with the implication of organic and colloid chemistry, to prepare micro- and mesoporous materials; surface and adsorption sciences sustained by theory and modelling to understand the peculiar behaviour of molecules in confined systems; special branches of catalysis, physics, chemical engineering and life science to design novel applications. * This book summarizes the developments in the area of nanoporous solids at the dawn of the 21st century, useful for both students/young researchers entering the field of nanoporous materials, as well as for senior scientists * Also summarizes the new family of porous compounds, e.g. MOF's and ordered porous carbon * The present state-of-the-art and prospects of nanoporous solids for advanced applications is discussed

This book describes the photocatalytic mechanism, factors affecting photocatalytic activity, design and preparation of different kinds of nanostructured photocatalysts, and their applications in the environmental and energy fields. Further, it illustrates a broad range of modification methods including ion-doping, heterojunction, noble metal deposition, morphological control and sensitizations, which are used to extend the light absorption range of photocatalysts and reduce recombination between electrons and holes. Promising applications include water splitting, contaminant decomposition and photocatalytic reduction of CO2, which are closely related to environmental redemption and new energy development. The book offers an intriguing and useful guide for a broad readership in various fields of catalysis, material sciences, environment and energy.

The original properties of mesoporous molecular sieves are so unique that the design of most existing catalysts could be reconsidered. It might indeed be of interest to introduce MMS either as a support or as the active phase, merely on the basis of their high surface areas, narrow pore size distribution and flexibility in composition. The recent literature provides examples of MMS based catalysts of many types such as acid-base solids, supported metals and supported oxides, mixed oxides, anchored complexes and clusters, grafted organic functional groups and others. Examples of all these developments are documented in the present proceedings including some spectacular new proposals. The new metallic (Pt) mesophases are specially worth mentioning because they represent a new approach to producing non-supported highly dispersed metals. In these proceedings the reader will find feature articles and regular papers from many worldwide groups, covering all aspects of synthesis, physical characterization and catalytic reactivity of MMS and their chemically modified forms. It is actually remarkable that this recent development brought together an even broader spectrum of scientists from traditionally unrelated fields such as those of liquid crystals, surfactants, sol-gels, amorphous oxides and mixed oxides, solid state, adsorbents and heterogeneous catalysts. Obviously, this is a fast-growing research area which triggers the imagination and creativity at the cross-road between material design, molecular surface tailoring and catalytic applications.

Mesoporous silica materials, discovered in 1992 by the Mobile Oil Corporation, have received considerable attention in the chemical industry due to their superior textual properties such as high surface area, large pore volume, tunable pore diameter, and narrow pore size distribution. Among those materials, MCM-41, referred to Mobile Composition of Matter NO. 41, contains honeycomb liked porous structure that is the most common mesoporous molecular sieve studied. Applications of MCM-41 type mesoporous silica material in biomedical field as well as catalytical field have been developed and discussed in this thesis. The unique features of mesoporous silica nanoparticles were utilized for the design of delivery system for multiple biomolecules as described in chapter 2. We loaded luciferin into the hexagonal channels of MSN and capped the pore ends with gold nanoparticles to prevent premature release. Luciferase was adsorbed onto the outer surface of the MSN. Both the MSN and the gold nanoparticles were protected by poly-ethylene glycol to minimize nonspecific interaction of luciferase and keep it from denaturating. Controlled release of luciferin was triggered within the cells and the enzymatic reaction was detected by a luminometer. Further developments by varying enzyme/substrate pairs may provide opportunities to control cell behavior and

manipulate intracellular reactions. MSN was also served as a noble metal catalyst support due to its large surface area and its stability with active metals. We prepared MSN with pore diameter of 10 nm (LP10-MSN) which can facilitate mass transfer. And we successfully synthesized an organo silane, 2,2'-Bipyridine-amide-triethoxylsilane (Bpy-amide-TES). Then we were able to functionalize LP10-MSN with bipyridinyl group by both post-grafting method and co-condensation method. Future research of this material would be platinum complexation. This Pt (II) complex catalyst has been reported for a C-H bond activation reaction as an alternative of the traditional Friedel-Crafts reaction. And we will compare the turnover numbers of MSN supported material with homogenous catalyst to evaluate the catalytical efficiency of our material.

This book entitled "Biodiesel: Quality, Emissions and By-products" covers topics related to biodiesel quality, performance of combustion engines that use biodiesel and the emissions they generate. New routes to determinate biodiesel properties are proposed and the process how the raw material source, impurities and production practices can affect the quality of the biodiesel is analyzed. In relation to the utilization of biofuel, the performance of combustion engines fuelled by biodiesel and biodiesels blends are evaluated. The applications of glycerol, a byproduct of the biodiesel production process as a feedstock for biotechnological processes, and a key compound of the biorefinery of the future is also emphasized.

Porous materials continue to attract considerable attention because of their wide variety of scientific and technological applications, such as catalysis, shape- and size-selective absorption and adsorption, gas storage, and electrode materials. Both research and applications of porous materials—via electroanalysis, electrosynthesis, sensing, fuel cells, capacitors, electro-optical devices, etc.—heavily rely on electrochemistry. Electrochemistry of Porous Materials focuses on generalized theoretical modeling and describes redox processes for different porous materials, assessing their electrochemical applications. Considering the large variety of materials that can be classified as porous, the text focuses on nanostructured micro- and mesoporous materials. Using this approach, the book offers a more focused and practical analysis of key porous materials that are considered relatively homogeneous from an electrochemical point of view. These include: Porous silicates and aluminosilicates Porous metal oxides and related compounds Porous polyoxometalates Metal-organic frameworks Porous carbons, nanotubes, and fullerenes Porous polymers and certain hybrid materials With its detailed presentation of advances in electrochemistry of nanostructured materials, this text specifically addresses the foundation and applications of the electrochemistry of microporous materials. It incorporates the latest breakthroughs in applied fields (development of fuel cells, supercapacitors, etc.) and fundamental research (in areas including fractal scaling, photoelectrocatalysis, magnetoelectrochemistry, etc.). Designed to make the topic accessible and understandable for researchers and graduate students working in the field of material chemistry, this volume approximates porous materials chemistry to electrochemists. Selective and streamlined, it culls a wide range of relevant and practically useful material from the extensive literature on the subject, making it an invaluable reference for readers of all levels of understanding.

Over the past twenty years, Catalysis by Heteropolyacids (HPAs) has received wide attention and led to new and promising developments both at academic and industrial level. In particular, heterogeneous catalysis is particularly attractive because it generally satisfies most of green chemistry’s requirements. By emphasizing the development of third generation catalysts, this volume presents trends and opportunities in academic and industrial research. The book appeals to postgraduates, researchers, and chemists working in the field of environmentally benign catalysts as well as catalytic processes.

Mesoporous materials are a class of molecules with a large and uniform pore size, highly regular nanopores, and a large surface area. This book is devoted to all aspects and types of these materials and describes, in an in-depth and systematic manner, the step-by-step synthesis and its mechanism, as well as the characterization, morphology control, hybridization, and applications, of mesoporous molecular sieves. In so doing, it covers silicates, metal-doped silicates, nonsilicates, and organic-inorganic hybrids. Although the emphasis is on synthesis, the expert authors also discuss characterization and applications, ranging from catalysis and biochemistry to optics and the use of these materials as templates for nanomaterial synthesis. Both the fundamentals and the latest research results are covered, ensuring that this monograph serves as a reference for researchers in and newcomers to the field.

Different titanium-containing hybrid mesoporous materials have been successfully synthesized from cyclopentadienyl or alkoxo titanium derivatives as titanium sources. The immobilization of the titanium complex has been carried out by grafting or tethering method in order to compare the catalytic performance of each process. Furthermore, two different capped agents have been used to silylate the support surface in order to increase the hydrophobic character of the final catalyst. In chapter 6 it would be evaluated if the choice of the capped agent employed has consequences in the activity of the catalyst in determined epoxidation reactions.

The aim of this book has been to explore the variety of phenomena associated with the major forms of the material, while laying the foundation for a clear and detailed working and understanding of the materials. We tried to present new types of advanced materials, which are currently a hot topic, and provide readers with a selective review of important improvements in the field. I believe that every chapter in this book presents the progress in the subject and describes the latest advances in microporous and mesoporous materials.

Phenylpropionates—Advances in Research and Application: 2012 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Phenylpropionates. The editors have built Phenylpropionates—Advances in Research and Application: 2012 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Phenylpropionates in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Phenylpropionates—Advances in Research and Application: 2012 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

The dissertation begins with Chapter 1, which is a general introduction of the fundamental synthesis of mesoporous silica materials, the selective functionlization of mesoporous silica materials, and the synthesis of nanostructured porous materials via nanocasting. In Chapter 2, the thermo-responsive polymer coated mesoporous silica nanoparticles (MSN) was synthesized via surface-initated polymerization and exhibited unique partition activities in a biphasic solution with the thermally induced change. In Chapter 3, the monodispersed spherical MSN with different mesoporous structure (MCM-48) was developed and employed as a template for the synthesis of mesoporous carbon nanoparticles (MCN) via nanocasting. MCN was demonstrated for the delivery of membrane impermeable chemical agents inside the cells. The cellular uptake efficiency and biocompabtibility of MCN with human

cervical cancer cells were also investigated. In addition to the biocompabtibility of MCN, MCN was demonstrated to support Rh-Mn nanoparticles for catalytic reaction in Chapter 4. Owing to the unique mesoporosity, Rh-Mn nanoparticles can be well distributed inside the mesoporous structure and exhibited interesting catalytic performance on CO hydrogenation. In Chapter 5, the synthesis route of the aforementioned MCM-48 MSN was discussed and investigated in details and other metal oxide nanoparticles were also developed via nanocasting by using MCM-48 MSN as a template. At last, there is a general conclusion summarized in Chapter 6.

Synthesis, Characterization, and Application of Surface-functionalized Ordered Mesoporous Nanoparticles

The book "Redox" provides vast insight into the oxidation-reduction reactions to its readers. The book consists of three sections that include redox in the coordination compounds, organic compounds and polymerization; redox in electrochemistry; and redox and fish welfare. The first section consists of three chapters that describe the role of redox reactions in several fields such as transition metal chemistry, degradation processes of toxic compounds and dyes in treatment of water and wastewater, the catalysis of oxidation of organic compounds by metal active sites, and synthesis of copolymers. The second section consists of two chapters. The role of redox reactions and reactivity description of compounds are discussed in the second section of the book. The non-aqueous redox flow batteries are described in this section. The third section extensively discusses the redox balance and fish welfare and consists of one chapter.

Winner of 2018 PROSE Award for MULTIVOLUME REFERENCE/SCIENCE This encyclopedia offers a comprehensive and easy reference to physical organic chemistry (POC) methodology and techniques. It puts POC, a classical and fundamental discipline of chemistry, into the context of modern and dynamic fields like biochemical processes, materials science, and molecular electronics. Covers basic terms and theories into organic reactions and mechanisms, molecular designs and syntheses, tools and experimental techniques, and applications and future directions Includes coverage of green chemistry and polymerization reactions Reviews different strategies for molecular design and synthesis of functional molecules Discusses computational methods, software packages, and more than 34 kinds of spectroscopies and techniques for studying structures and mechanisms Explores applications in areas from biology to materials science The Encyclopedia of Physical Organic Chemistry has won the 2018 PROSE Award for MULTIVOLUME REFERENCE/SCIENCE. The PROSE Awards recognize the best books, journals and digital content produced by professional and scholarly publishers. Submissions are reviewed by a panel of 18 judges that includes editors, academics, publishers and research librarians who evaluate each work for its contribution to professional and scholarly publishing. You can find out more at: proseawards.com Also available as an online edition for your library, for more details visit Wiley Online Library

In the past few decades, the increasingly routine use of advanced structural probes for studying the structure and dynamics of the solid state has led to some dramatic developments in the field of porous solids. These materials are fundamental in a diverse range of applications, such as shape-selective catalysts for energy-efficient organic transformations, new media for pollutant removal, and gas storage materials for energy technologies. Porosity in inorganic materials may range from the nano-scale to the macro-scale, and the drive towards particular properties remains the goal in this fast-developing area of research. Covering some of the key families of inorganic solids that are currently being studied, Porous Materials discusses: Metal Organic Frameworks Materials Mesoporous Silicates Ordered Porous Crystalline Transition Metal Oxides Recent Developments in Templated Porous Carbon Materials Synthetic Silicate Zeolites: Diverse Materials Accessible Through Geoinspiration Additional volumes in the Inorganic Materials Series: Low-Dimensional Solids | Molecular Materials | Functional Oxides | Energy Materials

With the recent advent of nanotechnology, research and development in the area of nanostructured materials has gained unprecedented prominence. Novel materials with potentially exciting new applications are being discovered at a much higher rate than ever before. Innovative tools to fabricate, manipulate, characterize and evaluate such materials are being developed and expanded. To keep pace with this extremely rapid growth, it is necessary to take a breath from time to time, to critically assess the current knowledge and provide thoughts for future developments. This book represents one of these moments, as a number of prominent scientists in nanostructured materials join forces to provide insightful reviews of their areas of expertise, thus offering an overall picture of the state-- the art of the field. Nanostructured materials designate an increasing number of materials with designed shapes, surfaces, structures, pore systems, etc. Nanostructured materials with modified surfaces include those whose surfaces have been altered via such techniques as grafting and tethering of organic or organometallic species, or through various deposition procedures including electro, electroless and vapor deposition, or simple adsorption. These materials find important applications in catalysis, separation and environmental remediation. Materials with patterned surfaces, which are essential for the optoelectronics industry, constitute another important class of surface-modified nanostructured materials. Other materials are considered nanostructured because of their composition and internal organization.

The development of facile synthetic methods to synthesize porous functional materials has attracted significant attention because of the various advantages these materials possess (in terms of properties and potential applications) compared with their nonporous counterparts. In this dissertation, several synthetic strategies that were developed to make some novel carbon- and silica-based porous nanomaterials, along with their properties and potential applications in electrocatalysis and drug delivery have been compiled. In Chapter 1, the various synthetic methods used to synthesize novel nanoporous silica materials, and their properties and potential applications, specifically in biomedical areas, are summarized. In addition, synthetic approaches developed to make porous carbon nanomaterials, with an emphasis on biomass-derived carbon nanomaterials, are discussed. Carbon nanomaterials are excellent candidate materials for electrochemical energy conversions, electrocatalysis, and drug adsorption / release. These topics have also been discussed in this and the subsequent chapters. In Chapter 2, the synthesis of N-doped monodispersed mesoporous carbon nanoparticles by using the self-assembled polyaniline (PANI) and colloidal silica aggregates as precursors is described. The resulting nitrogen-doped carbon materials are shown to serve as active electrocatalysts for hydrogen peroxide reduction and oxygen reduction reaction reactions, reactions that are pertinent to renewable energy and fuel

cells. The advantageous features of the nanoporous structures of the materials on their electrocatalytic properties are further discussed. In addition, the method developed for PANI is shown to be versatile enough to be extended to other polymers, such as polypyrrole. Carbon nanomaterials can be prepared not only from synthetic materials, but also from sustainable precursors such as biomass. In Chapter 3, a novel synthetic method that allows morphology-controllable synthesis of carbon materials by coating shaped natural precursors with silica shells, followed by their pyrolysis and removal of the silica shells, is discussed. By applying this method to yeast cells and yeast cell walls, yeast cells-derived hollow core/shell carbon microparticles and yeast cell wall-derived carbon particles are synthesized. The former shows better electrocatalytic properties than the latter, indicating that the proteins, phospholipids, DNAs and RNAs within yeast cells are indirectly responsible for its higher electrocatalytic activity, by providing the carbon materials with more heteroatom dopants. This method can be extended to a number of microorganisms and plant materials (e.g., pollen) for the synthesis of other shape-controlled carbon nanomaterials and catalysts. Besides their potential applications for electrocatalysis, these porous carbon materials can play important roles in biomedical applications. In Chapter 4, carbon microparticles with high surface area prepared from yeast cell that are presented in Chapter 3 are further successfully used as support materials to improve the dissolution of a poorly soluble drug fenofibrate. Compared with the bulk fenofibrate, the fenofibrate-loaded carbon microparticles are found to release the drug much faster. In Chapter 5, comparative studies of the adsorption of DNA by two different kinds of mesoporous silica materials, namely KCC-1 and MCM-41, is discussed. Due to their beneficial dendritic and fibrous-like pores, KCC-1 nanoparticles can load more DNA molecules, whereas MCM-41, which has smaller cylindrical pores, has limited adsorption capacity for DNA. KCC-1 is also found to be reasonably biocompatible and is proven to be capable of carrying DNA molecules into the cells and has the potential for DNA delivery. In Chapter 6, glutathione-triggered release of model drug molecules from the pores of MCM-41-type mesoporous silica nanoparticles is described. Such nanomaterials with stimuli-triggered drug release properties are quite valuable to minimize or completely overcome the potential side effects of many types of drugs. Apart from carbon- and silica-based nanomaterials, TiO2 (P25) nanomaterials, which have inherent photocatalytic properties, are studied for photo conversion of bioactive molecules. Specifically the photocatalyzed conversion of caffeine and isocaffeine with the help of P25 nanomaterials is investigated, and the results are described in Chapter 7. The cytotoxicity, genotoxicity of caffeine and isocaffeine, as well as their converted products are also evaluated. In summary, in this dissertation a range of novel porous nanomaterials along with their properties and potential applications for electrocatalysis and nanomedicine are presented. The research in this field is likely to expand more in the near future.
The first comprehensive textbook on the timely and rapidly developing topic of inorganic porous materials This is the first textbook to completely cover a broad range of inorganic porous materials. It introduces the reader to the development of functional porous inorganic materials, from the synthetic zeolites in the 50’s, to today’s hybrid materials such as metal-organic frameworks (MOFs), covalent organic frameworks (COFs) and related networks. It also provides the necessary background to understand how porous materials are organized, characterized, and applied in adsorption, catalysis, and many other domains. Additionally, the book explains characterization and application from the materials scientist viewpoint, giving the reader a practical approach on the characterization and application of the respective materials. Introduction to Inorganic Porous Materials begins by describing the basic concepts of porosity and the different types of pores, surfaces, and amorphous versus crystalline materials, before introducing readers to nature’s porous materials. It then goes on to cover everything from adsorption and catalysis to amorphous materials such as silica to inorganic carbons and Periodic Mesoporous Organosilicas (PMOs). It discusses the synthesis and applications of MOFs and the broad family of COFs. It concludes with a look at future prospects and emerging trends in the field. The only complete book of its kind to cover the wide variety of inorganic and hybrid porous materials A comprehensive reference and outstanding tool for any course on inorganic porous materials, heterogeneous catalysis, and adsorption Gives students and investigators the opportunity to learn about porous materials, how to characterize them, and understand how they can be applied in different fields Introduction to Inorganic Porous Materials is an excellent book for students and professionals of inorganic chemistry and materials science with an interest in porous materials, functional inorganic materials, heterogeneous catalysis and adsorption, and solid state characterization techniques.
Ketone Bodies—Advances in Research and Application: 2012 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Ketone Bodies. The editors have built Ketone Bodies—Advances in Research and Application: 2012 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Ketone Bodies in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Ketone Bodies—Advances in Research and Application: 2012 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.
Mesoporous silica has large-scale industrial applications such as catalysis, drug delivery and bio/chemical absorptions. This book is devoted to all aspects and types of this material, focusing synthesis of mesoporous silica with anionic amphiphilic molecules. Characterization, properties, and applications are also discussed, making the book an essential reference for material scientists, chemists, and chemical Engineer.
Electrochemistry is the branch of chemistry that deals with the chemical action of electricity and the production of electricity by chemical reactions. In a world short of energy sources yet long on energy use, electrochemistry is a critical component of the mix necessary to keep the world economies growing. Electrochemistry is involved with such important applications as batteries, fuel cells, corrosion studies, hydrogen energy conversion, bioelectricity. Research on

electrolytes, cells, and electrodes is within the scope of this old but extremely dynamic field. This new book gathers leading research from throughout the world.

Demand for better reliability from drug delivery systems has caused designers and researchers to move away from trial-and-error approaches and toward model-based methods of product development. Developing such models requires cross-disciplinary physical, mathematical, and physiological knowledge. Combining these areas under a single cover, Understanding Drug Release and Absorption Mechanisms builds a firm understanding ofall elements needed to conceive, build, and implement successful models of drug release. Written by experts with broad industrial and academic experience, this book discusses the underlying physical principles, shows how to build mathematical models based on these principles, and finally compares the resulting models with experimental results. The authors begin by introducing the basics of modeling, physiological details of gastrointestinal and dermal absorption pathways, rheology, mass transport and thermodynamics, dissolution and partitioning, as well as size effects on the dissolution of crystallites. From this baseline, the authors explore applications in drug release from various delivery systems, specifically matrix systems, microemulsions, and permeability through membranes. Working systematically from theory to working models, Understanding Drug Release and Absorption Mechanisms: A Physical and Mathematical Approach demonstrates the steps involved in designing, building, and implementing realistic and reliable models of drug release without unrealistically simplifying the theoretical parameters.

The two volumes of Handbook of Gas Sensor Materials provide a detailed and comprehensive account of materials for gas sensors, including the properties and relative advantages of various materials. Since these sensors can be applied for the automation of myriad industrial processes, as well as for everyday monitoring of such activities as public safety, engine performance, medical therapeutics, and in many other situations, this handbook is of great value. Gas sensor designers will find a treasure trove of material in these two books.

The basic theme of this book is to understand the fundamentals and importance of porous functional materials, their properties, and significant applications like solar cells, batteries, photovoltaics, energy conversions, and mesoporous materials. This book covers the fundamentals of mesoporous materials, and various methods of synthesis, properties, and applications in different sectors.

This volume builds on the previous two editions, Environmental Photochemistry Part I and Part II, which reflect the diverse range of activities in this highly dynamic research field. The chapters cover fundamental topics, from photocatalyst materials, surface-modified materials, reaction kinetics and reactor modelling, to translational research activities on chemical synthesis, energy conversion and water treatment. The applications of the new generation of LED irradiation sources and spectroscopic methods for elucidating reaction pathways are also covered in detail. This new volume maintains the ethos of the previous editions by further contributing to readers’ understanding of photochemical and photocatalytic processes for environmental applications.

Metal Oxide Nanoparticles A complete nanoparticle resource for chemists and industry professionals Metal oxide nanoparticles are integral to a wide range of natural and technological processes—from mineral transformation to electronics. Additionally, the fields of engineering, electronics, energy technology, and electronics all utilize metal oxide nanoparticle powders. Metal Oxide Nanoparticles: Formation, Functional Properties, and Interfaces presents readers with the most relevant synthesis and formulation approaches for using metal oxide nanoparticles as functional materials. It covers common processing routes and the assessment of physical and chemical particle properties through comprehensive and complementary characterization methods. This book will serve as an introduction to nanoparticle formulation, their interface chemistry and functional properties at the nanoscale. It will also act as an in-depth resource, sharing detailed information on advanced approaches to the physical, chemical, surface, and interface characterization of metal oxide nanoparticle powders and dispersions. Addresses the application of metal oxide nanoparticles and its economic impact Examines particle synthesis, including the principles of selected bottom-up strategies Explores nanoparticle formulation—a selection of processing and application routes Discusses the significance of particle surfaces and interfaces on structure formation, stability and functional materials properties Covers metal oxide nanoparticle characterization at different length scales With this valuable resource, academic researchers, industrial chemists, and PhD students can all gain insight into the synthesis, properties, and applications of metal oxide nanoparticles.

"A valuable addition to the literature by any measure and surely will prove its merit in years to come. The new knowledge that arises with its help will be impressive and of great benefit to humankind." —From the Foreword by E. J. Corey, Nobel Prize Laureate An invaluable guide to name reactions and reagents for homologations Name Reactions for Homologations, Part II of Wiley's Comprehensive Name Reactions series comprises a comprehensive treatise on name reactions for homologations. With contributions from world-recognized authorities in the field, this reference offers an up-to-date, concise compilation of the most commonly used and widely known name reactions and reagents. Part II discusses Rearrangements, Asymmetric C-C Bond Formation, and Miscellaneous Homologation Reactions. Arranged alphabetically by name reactions, the listing provides: Description of the reaction Historical perspective A mechanism for the reaction Variations and improvements on the reaction Synthetic utilities of the reaction Experimental details References to the current primary literature Armed with this invaluable resource, both students and professionals will have at their fingertips a comprehensive guide to important mechanisms and phenomena in homologation.

Porous materials are of scientific and technological importance because of the presence of voids of controllable dimensions at the atomic, molecular, and nanometer scales, enabling them to discriminate and interact with molecules and clusters. Interestingly the big deal about this class of materials is about the “nothingness” within — the pore space. International Union of Pure and Applied Chemistry (IUPAC) classifies porous materials into three categories — micropores of less than 2 nm in diameter, mesopores between 2 and 50 nm, and macropores of greater than 50 nm. In this book,

nanoporous materials are defined as those porous materials with pore diameters less than 100 nm. Over the last decade, there has been an ever increasing interest and research effort in the synthesis, characterization, functionalization, molecular modeling and design of nanoporous materials. The main challenges in research include the fundamental understanding of structure-property relations and tailor-design of nanostructures for specific properties and applications. Research efforts in this field have been driven by the rapid growing emerging applications such as biosensor, drug delivery, gas separation, energy storage and fuel cell technology, nanocatalysis and photonics. These applications offer exciting new opportunities for scientists to develop new strategies and techniques for the synthesis and applications of these materials. This book provides a series of systematic reviews of the recent developments in nanoporous materials. It covers the following topics: (1) synthesis, processing, characterization and property evaluation; (2) functionalization by physical and/or chemical treatments; (3) experimental and computational studies on fundamental properties, such as catalytic effects, transport and adsorption, molecular sieving and biosorption; (4) applications, including photonic devices, catalysis, environmental pollution control, biological molecules separation and isolation, sensors, membranes, hydrogen and energy storage, etc. Contents:Nanoporous Materials — An Overview (G Q Lu & X S Zhao)Advances in Mesoporous Materials Templated by Nonionic Block Copolymers (C Yu et al.)Zeolite/Mesoporous Molecular Sieve Composite Materials (D T On & S Kaliaguine)Chromium-Containing Ordered Nanoporous Materials (P Selvam)Surfactant-Templated Mesostructured Materials: Synthesis and Compositional Control (M S Wong & W V Knowles)Organic Host-Guest Structures in the Solid State (A Nangia)Nonsurfactant Route to Nanoporous Phenyl-Modified Hybrid Silica Materials (Y Wei et al.)3D Macroporous Photonic Materials Templated by Self Assembled Colloidal Spheres (Z C Zhou & X S Zhao)Hydrophobic Microporous Silica Membranes for Gas Separation and Membrane Reactors (S Giessler et al.)Synthesis and Characterization of Carbon Nanotubes for Hydrogen Storage (H-M Cheng et al.)Physical Adsorption Characterization of Ordered and Amorphous Mesoporous Materials (M Thommes)Molecular Simulation of Adsorption in Porous Materials (D Nicholson)Surface Functionalization of Ordered Nanoporous Silicates (X S Zhao et al.)Surface Alumination of Mesoporous Silicates (R Mokaya)Acidity Measurement of Nanoporous Aluminosilicates — Zeolites and MCM-41 (J Zheng et al.)Nanocatalysts Prepared by the Molecularly Designed Dispersion Process (P Cool et al.)Acidity-enhanced Nanoporous Catalytic Materials (F-S Xiao & Y Han)Modified Mesoporous Materials as Acid and Base Catalysts (D J Macquarrie)Lewis Acid/Base Catalysts Supported on Nanoporous Silica as Environmental Catalysts (V R Choudhary & B S Uphade)Nanoporous Catalysts for Shape-Selective Synthesis of Specialty Chemicals: A Review of Synthesis of 4,4'-Dialkylbiphenyl (J-P Shen & C Song)Catalysis Involving Mesoporous Molecular Sieves (W S Ahn et al.)Adsorption and Transport in Nanoporous Materials (J P B Mota)Adsorption of Organic Molecules in Nanoporous Adsorbents from Aqueous Solution (R Denoyel)Functionalized Nanoporous Adsorbents for Environmental Remediation (M C Burleigh & S Dai)Nanoporous Adsorbents for Air Pollutant Removal (P Le Cloirrec)Bioadsorption and Separation with Nanoporous Materials (A Daehler et al.)Nanoporous Materials as Supports for Enzyme Immobilization (H H P Yiu & P A Wright)A Novel Non-surfactant Route to Nanoporous Materials and its Biological Applications (Y Wei & K-Y Qiu) Readership: Researchers in nanotechnology, chemical engineering, physical chemistry and solid state chemistry.

A comprehensive introduction to the design, synthesis, characterization, and catalytic properties of nanoporous catalysts for the biomass conversion With the specter of peak oil demand looming on the horizon, and mounting concerns over the environmental impact of greenhouse gas emissions, biomass has taken on a prominent role as a sustainable alternative fuel source. One critical aspect of the biomass challenge is the development of novel catalytic materials for effective and controllable biomass conversion. Edited by two scientists recognized internationally for their pioneering work in the field, this book focuses on nanoporous catalysts, the most promising class of catalytic materials for the conversion of biomass into fuel and other products. Although various catalysts have been used in the conversion of biomass-derived feedstocks, nanoporous catalysts exhibit high catalytic activities and/or unique product selectivities due to their large surface area, open nanopores, and highly dispersed active sites. This book covers an array of nanoporous catalysts currently in use for biomass conversion, including resins, metal oxides, carbons, mesoporous silicates, polydivinylbenzene, and zeolites. The authors summarize the design, synthesis, characterization and catalytic properties of these nanoporous catalysts for biomass conversions, discussing the features of these catalysts and considering future opportunities for developing more efficient catalysts. Topics covered include: Resins for biomass conversion Supported metal oxides/sulfides for biomass oxidation and hydrogenation Nanoporous metal oxides Ordered mesoporous silica-based catalysts Sulfonated carbon catalysts Porous polydivinylbenzene Aluminosilicate zeolites for bio-oil upgrading Rice straw Hydrogenation for sugar conversion Lignin depolymerization Timely, authoritative, and comprehensive, Nanoporous Catalysts for Biomass Conversion is a valuable working resource for academic researchers, industrial scientists and graduate students working in the fields of biomass conversion, catalysis, materials science, green and sustainable chemistry, and chemical/process engineering.

This book presents the latest research in the field of heterogeneous catalysis. Heterogeneous catalysis and homogeneous catalysis are important factors in increasing the development of green chemistry. Some of the challenges that we are responsible for are directing research efforts toward increasing the kinetics of heterogeneous catalysis to homogeneous catalysis levels, improving the recyclability of the catalysts, and developing new supports that can act as catalysts or cocatalysts. Following reaction kinetics and mechanisms on supported catalysts provides the degree of precision and accuracy already enjoyed by the homogeneous catalysis community. The editors present an easily-accessible digest for researchers and a reference aimed at offering guidance to new researchers in the field. Priced at £110.00 or US$180.00.