

Zeolites In Sustainable Chemistry Synthesis Characterization And Catalytic Applications Green Chemistry And Sustainable Technology

Chemistry of Silica and Zeolite-Based Materials covers a wide range of topics related to silica-based materials from design and synthesis to applications in different fields of science and technology. Since silica is transparent and inert to the light, it is a very attractive host material for constructing artificial photosynthesis systems. As an earth-abundant oxide, silica is an ideal and basic material for application of various oxides, and the science and technology of silica-based materials are fundamentally important for understanding other oxide-based materials. The book examines nanosolvation and confined molecules in silica hosts, catalysis and photocatalysis, photonics, photosensors, photovoltaics, energy, environmental sciences, drug delivery, and health. Written by a highly experienced and internationally renowned team from around the world, Chemistry of Silica and Zeolite-Based Materials is ideal for chemists, materials scientists, chemical engineers, physicists, biologists, biomedical sciences, environmental scientists, toxicologists, and pharma scientists. --- "The enormous versatility of silica for building a large variety of materials with unique properties has been very well illustrated in this book.... The reader will be exposed to numerous potential applications of these materials – from photocatalytic, optical and electronic applications, to chemical reactivity in confined spaces and biological applications. This book is of clear interest not only to PhD students and postdocs, but also to researchers in this field seeking an understanding of the possible applications of meso and microporous silica-derived materials." - Professor Avelino Corma, Institute of Chemical Technology (ITQ-CSIC) and Polytechnical University of Valencia, Spain Discusses the most important advances in various fields using silica materials, including nanosolvation and confined molecules in silica hosts, catalysis and photocatalysis, and other topics Written by a global team of experts from a variety of science and technology disciplines Ideal resource for chemists, materials scientists, and chemical engineers working with oxide-based materials

Green chemistry already draws on many techniques and approaches developed by theoretical chemists, whilst simultaneously revealing a whole range of interesting new challenges for theoretical chemists to explore. Highlighting how work at the intersection of these fields has already produced beneficial results, Green Chemistry and Computational Chemistry: Shared Lessons in Sustainability is a practical, informative guide to combining green and theoretical chemistry principles and approaches in the development of more sustainable practices. Beginning with an introduction to both theoretical chemistry and green chemistry, the book goes on to explore current approaches being taken by theoretical chemists to address green and sustainable chemistry issues, before moving on to highlight ways in which green chemists are employing the knowledge and techniques of theoretical chemistry to help in developing greener processes. The future possibilities for theoretical chemistry in addressing sustainability issues are discussed, before a selection of case studies provides good insight into how these interactions and approaches have been successfully used in practice. Highlights the benefits of green and theoretical chemistry groups working together to tackle sustainability issues across both academia and industry Supports readers in easily selecting the most appropriate path through the book for their own needs Presents a range of examples examining the practical implications and outcomes of interdisciplinary approaches

Zeolites in Sustainable Chemistry Synthesis, Characterization and Catalytic Applications Springer

The term 'green chemistry' was coined by Anastas and Warner in the early 1990s and it is nowadays the mainstay of designing and implementing advanced chemical processes that decrease or eliminate the use and generation of hazardous substances whilst minimizing energy consumption. Solution Combustion Synthesis of Nanostructured Solid Catalysts for Sustainable Chemistry is an interdisciplinary collection of fundamental and applied cutting-edge studies which highlight general and specific aspects of the synthesis of nanostructured catalysts through Solution Combustion Synthesis (SCS), studying their applications from the perspective of green chemistry. This book intends to integrate the fundamental principles of the SCS process with its engineering aspects and covers the synthesis of a wide variety of catalytic materials. This reference book can be used as a permanent consulting material for students, researchers and the general readership for green chemistry, nanochemistry, materials science and chemical engineering.

Presents state-of-the-art knowledge of heterogeneous catalysts including new applications in energy and environmental fields This book focuses on emerging techniques in heterogeneous catalysis, from new methodology for catalysts design and synthesis, surface studies and operando spectroscopies, ab initio techniques, to critical catalytic systems as relevant to energy and the environment. It provides the vision of addressing the foreseeable knowledge gap unfilled by classical knowledge in the field. Heterogeneous Catalysts: Advanced Design, Characterization and Applications begins with an overview on the evolution in catalysts synthesis and introduces readers to facets engineering on catalysts; electrochemical synthesis of nanostructured catalytic thin films; and bandgap engineering of semiconductor photocatalysts. Next, it examines how we are gaining a more precise understanding of catalytic events and materials under working conditions. It covers bridging pressure gap in surface catalytic studies; tomography in catalysts design; and resolving catalyst performance at nanoscale via fluorescence microscopy. Quantum approaches to predicting molecular reactions on catalytic surfaces follows that, along with chapters on Density Functional Theory in heterogeneous catalysis; first principles simulation of electrified interfaces in electrochemistry; and high-throughput computational design of novel catalytic materials. The book also discusses embracing the energy and environmental challenges of the 21st century through heterogeneous catalysis and much more. Presents recent developments in heterogeneous catalysis with emphasis on new fundamentals and emerging techniques Offers a comprehensive look at the important aspects of heterogeneous catalysis Provides an applications-oriented, bottoms-up approach to a high-interest subject that plays a vital role in industry and is widely applied in areas related to energy and environment Heterogeneous Catalysts: Advanced Design, Characterization and Applications is an important book for catalytic chemists, materials scientists, surface chemists, physical chemists, inorganic chemists, chemical engineers, and other professionals working in the chemical industry.

Zeolites are natural or synthetic materials with porous chemical structures that are valuable due to their absorptive and catalytic qualities. Metal-Organic Frameworks (MOFs) are manmade organometallic polymers with similar porous structures. This introductory book, with contributions from top-class researchers from all around the world, examines these materials and explains the different synthetic routes available to prepare zeolites and MOFs. The book also highlights how the substances are similar yet different and how they are used by science and industry in situations ranging from fueling cars to producing drugs.

This volume is a complete progress report on the various aspects of zeolite synthesis on a molecular level. It provides many examples that illustrate how zeolites can be crystallized and what the important parameters are that control crystallization. Forty-two chapters cover such topics as: crystallization techniques; gel chemistry; crystal size and morphology; the role of organic compounds; and novel synthesis procedures. It offers a complete review of zeolite synthesis as well as the latest finding in this important field. Contains benchmark contributions from many notable pioneers in the field, including R.M. Barrer, H. Robson, and Robert Milton.

This book details zeolites, their structures and the parameters that influence their synthesis, providing a new and actual perspective of this field. Following this, the authors show different processes used to synthesize zeolites using residues, natural materials, and other eco-friendly materials such as raw powder glass, clays, aluminum cans, diatomites, rice ashes or coal ashes. Finally, this book gives the reader a wide range of different synthesis methods that they can be applied to several industrial processes.

Zeolites and Zeolite-like Materials offers a comprehensive and up-to-date review of the important areas of zeolite synthesis,

characterization, and applications. Its chapters are written in an educational, easy-to-understand format for a generation of young zeolite chemists, especially those who are just starting research on the topic and need a reference that not only reflects the current state of zeolite research, but also identifies gaps and opportunities. The book demonstrates various applications of zeolites in heterogeneous catalysis and biomass conversion and identifies the endless possibilities that exist for this class of materials, their structures, functions, and future applications. In addition, it demonstrates that zeolite-like materials should be regarded as a living body developing towards new modern applications, thereby responding to the needs of modern technology challenges, including biomass conversion, medicine, laser techniques, and nanomaterial design, etc. The book will be of interest not only to zeolite-focused researchers, but also to a broad scientific and non-scientific audience. Provides a comprehensive review of the literature pertaining to zeolites and zeolite-like materials since 2000 Covers the chemistry of novel zeolite-like materials such as Metal-Organic Frameworks (MOFs), Covalent Organic Frameworks (COFs), hierarchical zeolite materials, new mesoporous and composite zeolite-like micro/mesoporous materials Presents essential information of the new zeolite-like structures, with a balanced coverage of the most important areas of the zeolite research (synthesis, characterization, adsorption, catalysis, new applications of zeolites and zeolite-like materials) Contains chapters prepared by known specialists who are members of the International Zeolite Association

This volume looks at modern approaches to catalysis and reviews the extensive literature which bridges the gap from academic studies in the laboratory to practical applications in industry not only for catalysis field but also for environmental protection.

This edited volume focuses on the host-guest chemistry of organic molecules and inorganic systems during synthesis (structure-direction). Organic molecules have been used for many years in the synthesis of zeolitic nanoporous frameworks. The addition of these organic molecules to the zeolite synthesis mixtures provokes a particular ordering of the inorganic units around them that directs the crystallization pathway towards a particular framework type; hence they are called structure-directing agents. Their use has allowed the discovery of an extremely large number of new zeolite frameworks and compositions. This volume covers the main aspects of the use of organic molecules as structure-directing agents for the synthesis of zeolites, including first an introduction of the main concepts, then two chapters covering state-of-the-art techniques currently used to understand the structure-directing phenomenon (location of molecules by XRD and molecular modeling techniques). The most recent trends in the types of organic molecules used as structure-directing agents are also presented, including the use of metal-complexes, the use of non-ammonium-based molecules (mainly phosphorus-based compounds) and the role of supramolecular chemistry in designing new large organic structure-directing agents produced by self-aggregation. In addition the volume explores the latest research attempting to transfer the asymmetric nature of organic chiral molecules used as structure-directing agents to the zeolite lattice to produce chiral enantioselective frameworks, one of the biggest challenges today in materials chemistry. This volume has interdisciplinary appeal and will engage scholars from the zeolite community with a general interest in microporous materials, which involves not only zeolite scientists, but also researchers working on metal-organic framework materials. The concepts covered will also be of interest for researchers working on the application of materials after encapsulation of molecules of interest in post-synthetic treatments. Further the work explores the main aspects of host-guest chemistry in hybrid organo-inorganic templated materials, which covers all types of materials where organic molecules are used as templates and are confined within framework-structured inorganic materials (intercalation compounds). Therefore the volume is also relevant to the wider materials chemistry community.

In recent years the need for sustainable process design and alternative reaction routes to reduce industry's impact on the environment has gained vital importance. The book begins with a general overview of new trends in designing industrial chemical processes which are environmentally friendly and economically feasible. Specific examples written by experts from industry cover the possibilities of running industrial chemical processes in a sustainable manner and provide an up-to-date insight into the main concerns, e.g., the use of renewable raw materials, the use of alternative energy sources in chemical processes, the design of intrinsically safe processes, microreactor and integrated reaction/ separation technologies, process intensification, waste reduction, new catalytic routes and/or solvent and process optimization.

Encapsulated Catalysts provides valuable information for chemists, chemical engineers, and materials scientists in this promising area. The book describes many kinds of encapsulated catalysts and their applications in chemistry, including organic, inorganic, hybrid, and biological systems. Unlike other works, which discuss traditional supports, this useful resource uniquely focuses on extremely important topics, such as the encapsulation effects on reactivity and selectivity, the difficulty of their separation from reaction mixture, and/or their sensitivity to reaction conditions, and the limit of their industrial applications. In addition, the book covers the immobilization of homogenous catalysts on inorganic or organic supports and how it enables the separation of homogenous catalysts, as well as the protection or reuse of catalysts. Discusses one of the most promising advances in catalysis and recent developments in the area, including enzyme mimic catalysts and new nano-materials for catalyst encapsulation Provides interdisciplinary coverage of organic, inorganic, and biological materials for encapsulation of catalysts Describes various types of reactions which can be catalyzed in presence of encapsulated catalysts

Nanoparticles exhibit a range of different properties when compared to bulk materials. Their high surface-area to volume ratio makes them particularly attractive for use as catalysts and recent years have seen an explosion of research in this area. The ability to fine-tune the size and structure of nanoparticles means that it is possible to design catalytic materials for improved activity or specificity. As catalysis is one of the key technologies for more sustainable production of both chemicals and energy, the past few years have seen increasing numbers of nanomaterials reported for these applications. Depending on the application, a number of different catalyst synthesis and optimization protocols can be used. This book provides comprehensive links between the design and fabrication method for nanoparticles and their catalytic performance (activity, selectivity and stability) in various applications. Presenting an introduction to the concept of catalyst design and recent developments in the preparation and characterisation of nanomaterials, followed by several chapters on the design of catalysts for specific applications, this book is a valuable resource for researchers working on catalytic reactions, industrial processes and nanomaterial applications.

Modified Clay and Zeolite Nanocomposite Materials: Environmental and Pharmaceutical Applications retraces the most important knowledge gaps that the scientific community is facing, including a drawback of real-world applications. This valuable resource explores the novel applications of this group of nanomaterials that can be suitably surface-modified to obtain properties that can be applied in environmental and pharmaceutical fields. For example, modification with surfactants has given new motivation to the study of these materials by producing an inversion in the ion exchange behavior from cationic to anionic. This strategy has paved

the way for new uses highlighted in this timely resource. Explores the combination of both minerals (clay and zeolite) together, with their application in two broad areas of emerging research Explains better utilization and applications for modified clay and zeolite through detailed comparative studies Consolidates information on the modification and tuning of clay and zeolite materials for novelty applications Helps users in the selection of materials, surface features, and other functionalization for diverse applications Bioenergy Systems for the Future: Prospects for Biofuels and Biohydrogen examines the current advances in biomass conversion technologies for biofuels and biohydrogen production, including their advantages and challenges for real-world application and industrial-scale implementation. In its first part, the book explores the use of lignocellulosic biomass and agricultural wastes as feedstock, also addressing biomass conversion into biofuels, such as bioethanol, biodiesel, bio-methane, and bio-gasoline. The chapters in Part II cover several different pathways for hydrogen production, from biomass, including bioethanol and bio-methane reforming and syngas conversion. They also include a comparison between the most recent conversion technologies and conventional approaches for hydrogen production. Part III presents the status of advanced bioenergy technologies, such as applications of nanotechnology and the use of bio-alcohol in low-temperature fuel cells. The role of advanced bioenergy in a future bioeconomy and the integration of these technologies into existing systems are also discussed, providing a comprehensive, application-oriented overview that is ideal for engineering professionals, researchers, and graduate students involved in bioenergy. Explores the most recent technologies for advanced liquid and gaseous biofuels production, along with their advantages and challenges Presents real-life application of conversion technologies and their integration in existing systems Includes the most promising pathways for sustainable hydrogen production for energy applications

Widely used in adsorption, catalysis and ion exchange, the family of molecular sieves such as zeolites has been greatly extended and many advances have recently been achieved in the field of molecular sieves synthesis and related porous materials. Chemistry of Zeolites and Related Porous Materials focuses on the synthetic and structural chemistry of the major types of molecular sieves. It offers a systematic introduction to and an in-depth discussion of microporous, mesoporous, and macroporous materials and also includes metal-organic frameworks. Provides focused coverage of the key aspects of molecular sieves Features two frontier subjects: molecular engineering and host-guest advanced materials Comprehensively covers both theory and application with particular emphasis on industrial uses This book is essential reading for researches in the chemical and materials industries and research institutions. The book is also indispensable for researches and engineers in R&D (for catalysis) divisions of companies in petroleum refining and the petrochemical and fine chemical industries.

Green Chemistry: An Inclusive Approach provides a broad overview of green chemistry for researchers from either an environmental science or chemistry background, starting at a more elementary level, incorporating more advanced concepts, and including more chemistry as the book progresses. Every chapter includes recent, state-of-the-art references, in particular, review articles, to introduce researchers to this field of interest and provide them with information that can be easily built upon. By bringing together experts in multiple subdisciplines of green chemistry, the editors have curated a single central resource for an introduction to the discipline as a whole. Topics include a broad array of research fields, including the chemistry of Earth's atmosphere, water and soil, the synthesis of fine chemicals, and sections on pharmaceuticals, plastics, energy related issues (energy storage, fuel cells, solar, and wind energy conversion etc.), greenhouse gases and their handling, chemical toxicology issues of everyday products (from perfumes to detergents or clothing), and environmental policy issues. Introduces the topic of green chemistry with an overview of key concepts Expands upon presented concepts with the latest research and applications, providing both the breadth and depth researchers need Includes a broad range of application based problems to make the content accessible for professional researchers and undergraduate and graduate students Authored by experts in a broad range of fields, providing insider information on the aspects or challenges of a given field that are most important and urgent

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.

Recent Advances in Science and Technology of Zeolites and Related Materials is a collection of oral and poster communications, presented during the 14th International Zeolite Conference (IZC). The conference was hosted by the Catalysis Society of South Africa. In the tradition of the IZC series, this Conference provides a forum for the presentation of new knowledge in the science and technology of zeolites and related materials. Papers presented cover a wide range

of topics that include synthesis, structure determination, characterisation, modelling, and catalysis. This highly visual book is a must for readers looking to stay up-to-date on zeolite science. * This three-part volume provides valuable information on zeolites and related materials * Includes papers that cover topics such as structure determination, modelling and separation processes * Contains new and exciting developments in the field

In the nearly 10 years since the publication of the bestselling first edition of Introduction to Green Chemistry, interest in green chemistry and clean processes has grown so much that topics, such as fluorous biphasic catalysis, metal organic frameworks, and process intensification, barely mentioned in the first edition, have become major areas of research. In addition, government funding has ramped up the development of fuel cells and biofuels. It reflects the evolving focus from pollution remediation to pollution prevention. Copiously illustrated with over 800 figures, this second edition provides an update from the frontiers of the field. New and expanded research topics: Metal-organic frameworks Solid acids for alkylation of isobutene by butanes Carbon molecular sieves Mixed micro- and mesoporous solids Organocatalysis Process intensification and gas phase enzymatic reactions Hydrogen storage for fuel cells Reactive distillation Catalysts in action on an atomic scale Updated and expanded current events topics: Industry resistance to inherently safer chemistry Nuclear power Removal of mercury from vaccines Removal of mercury and lead from primary explosives Biofuels Uses for surplus glycerol New hard materials to reduce wear Electronic waste Smart growth The book covers traditional green chemistry topics, including catalysis, benign solvents, and alternative feedstocks. It also discusses relevant but less frequently covered topics with chapters such as Chemistry of Longer Wear and Population and the Environment. This coverage highlights the importance of chemistry to everyday life and demonstrates the benefits the expanded exploitation of green chemistry can have for society.

This book provides an unparalleled contemporary assessment of hydrocarbon chemistry – presenting basic concepts, current research, and future applications. • Comprehensive and updated review and discussion of the field of hydrocarbon chemistry • Includes literature coverage since the publication of the previous edition • Expands or adds coverage of: carboxylation, sustainable hydrocarbons, extraterrestrial hydrocarbons • Addresses a topic of special relevance in contemporary science, since hydrocarbons play a role as a possible replacement for coal, petroleum oil, and natural gas as well as their environmentally safe use • Reviews of prior edition: "...literature coverage is comprehensive and ideal for quickly reviewing specific topics...of most value to industrial chemists..." (Angewandte Chemie) and "...useful for chemical engineers as well as engineers in the chemical and petrochemical industries." (Petroleum Science and Technology)

"Handbook of Natural Zeolites provides a comprehensive and updated summary of all important aspects of natural zeolites science and technology. The e-book contains four sections covering the relevant scientific background, established technologies, recent "

Provides a complete and accessible A to Z collection of information on catalysis This updated and enlarged must-have edition of a classic book on catalysis explains the important terms of all aspects of the subject - including biocatalysis, homogeneous catalysis, heterogeneous catalysis - as well as the terms associated with it. It also looks at related topics like spectroscopy or analytical methods. Featuring 20% more content than the previous edition, it comprehensively covers the topic in a clear and concise manner, and includes abbreviations, brief biographic entries of important scientists who have worked in catalysis, trade names, important catalytic processes, named reactions, reactions, and other important keywords in the general field of catalysis. Written by more than 200 top scientists and with more than 15,000 entries on all aspects of catalysis, Catalysis from A to Z: A Concise Encyclopedia, 5th Edition is filled with figures, tables, cross-references, and references. It covers acids, ligands, catalytic reactions in organic synthesis, kinetics and thermodynamics of catalytic reactions, and catalyst labeling. The book also looks at theoretical backgrounds of catalytic reactions, industrial catalytic processes, autoclaves, colloids, nanomaterials, spectroscopically methods for catalyst analysis, and more. -Provides all the knowledge scientists need to know about homogeneous, heterogeneous, and biochemical catalysis -Includes more than 15,000 keywords in compact entries -Newly updated and expanded edition of the bestselling classic -Comprehensive, succinct, and easy to use -Edited by an experienced team of top editors and authors with contributions from over 200 scientific experts -Offers German and French translations of the keywords to help students and non-native English speakers Catalysis from A to Z: A Concise Encyclopedia is an ideal resource for every student, chemist, scientist, and engineer involved in catalytic chemistry, chemical engineering, biochemistry, organic chemistry, and more.

Membrane reactors increase chemical conversion by influencing the reaction equilibrium through a combination of reaction and separation. This book provides insight into designing membrane reactors for industrial application, the profile of the chemical reactions occurring and beneficial effects on the production yield and quality.

This book is devoted to the new development of zeolitic catalysts with an emphasis on new strategies for the preparation of zeolites, novel techniques for their characterization and emerging applications of zeolites as catalysts for sustainable chemistry, especially in the fields of energy, biomass conversion and environmental protection. Over the years, energy and the environment have become the most important global issues, while zeolitic catalysts play important roles in addressing them. With individual chapters written by leading experts, this book offers an essential reference work for researchers and professionals in both academia and industry. Feng-Shou Xiao is a Professor at the Department of Chemistry, Zhejiang University, China. Xiangju Meng is an Associate Professor at the Department of Chemistry, Zhejiang University, China.

Advanced Functional Solid Catalysts for Biomass Valorization presents the basic concepts in catalysis (homogeneous, heterogeneous, and enzymatic) and the properties of various kinds of heterogeneous solid catalysts, including their structure, porosity, particle size, BET surface area, acid-base, and redox properties. Useful information about biorefineries, types of biomass feedstocks, their structures and properties as well as about several potential catalytic routes for biomass upgrading to useful fuels and chemicals is provided in this book. Importantly, this book covers the most recent developments toward functionalization of various solid catalysts, optimization of catalysts' properties, developing cascade catalytic strategies, exploring reaction kinetics/mechanisms, and evaluating catalysts' stability/reusability during biomass

upgrading. Current challenges and opportunities for the future biorefineries as well as for the design of advanced functional solid catalysts are critically discussed. Describes catalysis as a promising technology for the development of eco-friendly and economically viable strategies for several important energy and environmental applications. Covers heterogeneous solid catalysts because of their versatile benefits in terms of catalysts' synthesis, production cost, stability, and reusability as compared to homogeneous liquid catalysts. Provides promising strategies for the design of new catalytic materials, such as carbon materials, metal-organic frameworks, zeolites, and mesoporous silicas. Describes functional solid catalysts for developing one-pot cascade processes for efficient biomass valorization and other vital chemical transformations. Reflecting the R&D efforts in the field that have resulted in a plethora of novel applications over the past decade, this handbook gives a comprehensive overview of the tangible benefits of nanotechnology in catalysis. By bridging fundamental research and industrial development, it provides a unique perspective on this scientifically and economically important field. While the first three parts are devoted to preparation and characterization of nanocatalysts, the final three provide in-depth insights into their applications in the fine chemicals industry, the energy industry, and for environmental protection, with expert authors reporting on real-life applications that are on the brink of commercialization. Timely reading for catalytic chemists, materials scientists, chemists in industry, and process engineers.

Natural resources, such as zeolite minerals, have an inexhaustible potential for scientific research and application. Both natural and synthetic zeolites have application in many researched areas including water and soil industries, biochemistry, and medicine due to their environmental and economic acceptability, unique structure, and specific characteristics. Over three sections, this book presents a comprehensive overview of zeolites and their potential applications in science. Chapters cover such topics as the history of zeolites, their structure and properties, layered zeolites, and use of zeolites for gas storage and separation as well as in veterinary medicine.

This book presents an introduction to the preparation and characterisation of nanomaterials and their design for specific catalytic applications. This book aims to stimulate and promote the wide-ranging aspects of green chemistry and its major role in ensuring sustainable development. The book covers the following areas: green chemistry; green reagents and atom economy; safeguarding the atmosphere; industrial green catalysis; alternative reaction conditions; biocatalysis and green chemistry. This book is based on the third edition of the Collection of Lectures of the Summer Schools on Green Chemistry held in Venice, Italy in the summers of 1998-2003 (sponsored by the European Commission, TMR and Improving Programmes and carried out by the Consortzio Interuniversitario La Chimica per l'Ambiente). Encyclopedia of Renewable and Sustainable Materials provides a comprehensive overview, covering research and development on all aspects of renewable, recyclable and sustainable materials. The use of renewable and sustainable materials in building construction, the automotive sector, energy, textiles and others can create markets for agricultural products and additional revenue streams for farmers, as well as significantly reduce carbon dioxide (CO₂) emissions, manufacturing energy requirements, manufacturing costs and waste. This book provides researchers, students and professionals in materials science and engineering with tactics and information as they face increasingly complex challenges around the development, selection and use of construction and manufacturing materials. Covers a broad range of topics not available elsewhere in one resource Arranged thematically for ease of navigation Discusses key features on processing, use, application and the environmental benefits of renewable and sustainable materials Contains a special focus on sustainability that will lead to the reduction of carbon emissions and enhance protection of the natural environment with regard to sustainable materials

Authored by a top-level team of both academic and industrial researchers in the field, this is an up-to-date review of mesoporous zeolites. The leading experts cover novel preparation methods that allow for a purpose-oriented fine-tuning of zeolite properties, as well as the related materials, discussing the specific characterization methods and the applications in close relation to each individual preparation approach. The result is a self-contained treatment of the different classes of mesoporous zeolites. With its academic insights and practical relevance this is a comprehensive handbook for researchers in the field and related areas, as well as for developers from the chemical industry.

Ever since the discovery of graphene, two-dimensional layered materials (2DLMs) have been the central tool of the materials research community. The reason behind their importance is their superlative and unique electronic, optical, physical, chemical and mechanical properties in layered form rather than in bulk form. The 2DLMs have been applied to electronics, catalysis, energy, environment, and biomedical applications. The following topics are discussed in the book's fifteen chapters: • The research status of the 2D metal-organic frameworks and the different techniques used to synthesize them. • 2D black phosphorus (BP) and its practical application in various fields. • Reviews the synthesis methods of MXenes and provides a detailed discussion of their structural characterization and physical, electrochemical and optical properties, as well as applications in catalysis, energy storage, environmental management, biomedicine, and gas sensing. • The carbon-based materials and their potential applications via the photocatalytic process using visible light irradiation. • 2D materials like graphene, TMDCs, few-layer phosphorene, MXene in layered form and their heterostructures. • The structure and applications of 2D perovskites. • The physical parameters of pristine layered materials, ZnO, transition metal dichalcogenides, and heterostructures of layered materials are discussed. • The coupling of graphitic carbon nitride with various metal sulfides and oxides to form efficient heterojunction for water purification. • The structural features, synthetic methods, properties, and different applications and properties of 2D zeolites. • The methods for synthesizing 2D hollow nanostructures are featured and their structural aspects and potential in medical and non-medical applications. • The characteristics and structural aspects of 2D layered double hydroxides (LDHs) and the various synthesis methods and role of LDH in non-medical applications as adsorbent, sensor, catalyst, etc. • The synthesis of graphene-based 2D layered materials synthesized by using top-down and bottom-up approaches where the main emphasis is on the hot-filament thermal chemical vapor deposition (HFTCVD) method. • The different properties of 2D h-BN and borophene and the various methods being used for the synthesis of 2D h-BN, along with their growth mechanism and transfer techniques. • The physical properties and current progress of various transition metal dichalcogenides (TMDC) based on photoactive materials for photoelectrochemical (PEC) hydrogen evolution reaction. • The state-of-the-art of 2D layered materials and associated devices, such as electronic, biosensing, optoelectronic, and energy storage applications.

This book is part of a two-volume work that offers a unique blend of information on realistic evaluations of catalyst-based synthesis processes using green chemistry principles and the environmental sustainability applications of such processes for biomass conversion, refining, and petrochemical production. The volumes provide a comprehensive resource of state-of-the-art technologies and green chemistry methodologies from researchers, academics, and chemical and manufacturing industrial scientists. The work will be of interest to professors, researchers, and practitioners in clean energy catalysis, green chemistry, chemical engineering and manufacturing, and environmental sustainability. This volume focuses on the potentials, recent advances, and future prospects of catalysis for biomass conversion and value-added chemicals production via green catalytic routes. Readers are presented with a mechanistic framework assessing the development of product selective catalytic processes for biomass and biomass-derived feedstock conversion. The book offers a unique combination of contributions from experts working on both lab-scale and industrial catalytic processes and provides insight into the use of various catalytic materials (e.g., mineral acids, heteropolyacid, metal catalysts, zeolites, metal oxides) for clean energy production and environmental sustainability.

Sustainable Nanoscale Engineering: From Materials Design to Chemical Processing presents the latest on the design of nanoscale materials and their applications in sustainable chemical production processes. The newest achievements of materials science, in particular nanomaterials, opened new opportunities for chemical engineers to design more efficient, safe, compact and environmentally benign processes. These materials include metal-organic frameworks, graphene, membranes, imprinted polymers, polymers of intrinsic microporosity, nanoparticles, and nanofilms, to name a few. Topics discussed include gas separation, CO₂ sequestration, continuous

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processes, waste valorization, catalytic processes, bioengineering, pharmaceutical manufacturing, supercritical CO₂ technology, sustainable energy, molecular imprinting, graphene, nature inspired chemical engineering, desalination, and more. Describes new, efficient and environmentally accepted processes for nanomaterials design Includes a large array of materials, such as metal-organic frameworks, graphene, imprinted polymers, and more Explores the contribution of these materials in the development of sustainable chemical processes This first book to focus on catalytic processes from the viewpoint of green chemistry presents every important aspect: · Numerous catalytic reductions and oxidations methods · Solid-acid and solid-base catalysis · C-C bond formation reactions · Biocatalysis · Asymmetric catalysis · Novel reaction media like e.g. ionic liquids, supercritical CO₂ · Renewable raw materials Written by Roger A. Sheldon -- without doubt one of the leaders in the field with much experience in academia and industry -- and his co-workers, the result is a unified whole, an indispensable source for every scientist looking to improve catalytic reactions, whether in the college or company lab.

Covering the breadth of zeolite chemistry and catalysis, this book provides the reader with a complete introduction to field, covering synthesis, structure, characterisation and applications. Beginning with the history of natural and synthetic zeolites, the reader will learn how zeolite structures are formed, synthetic routes, and experimental and theoretical structure determination techniques. Their industrial applications are covered in-depth, from their use in the petrochemical industry, through to fine chemicals and more specialised clinical applications. Novel zeolite materials are covered, including hierarchical zeolites and two-dimensional zeolites, showcasing modern developments in the field. This book is ideal for newcomers who need to get up to speed with zeolite chemistry, and also experienced researchers who will find this a modern, up-to-date guide.

An excellent overview of the field, covering in detail a wide range of different types of constituent materials, such as polymers, metals and metal oxides. It discusses their production and synthetic routes, as well as applications in several areas, including catalysis, drug delivery and environmental science. A must-have for scientists in academia and industry, as well as a valuable resource for both newcomers and more established researchers working in the field.

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