

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

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**Green Chemical** - Iyad Karamé 2017-07-05

Sustainable development and alternative energy constituted urgent needs in the last decade. Renewable chemicals, energy and bio-resource use became challenging topics in the sustainable, renewable and green sciences. This encourages and turns primordial needs the works in certain fields as developing of new and green catalysts for chemical transformations, in the domains of energy, environmental, pharmaceutical, agro-alimentary and cosmetically applications; evaluation of bio-resources compounds largely available for many applications in energy or as additives to fuels and other applications, reduction and conversion of greenhouse gas as well as developing new synthesis routes by avoiding the use of toxic and environmentally damage materials. In this book, the recent sustainable and green process is presented in three sections: "Greenhouse Gas Conversion Efficiency in Microwave", "Biomass Green Process" and "Green Synthesis and Catalysis".

**Nanoporous Catalysts for Biomass Conversion** - Feng-Shou Xiao 2017-09-05

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.

**Sustainable Nanoscale Engineering** - Gyorgy Szekely 2019-09-18

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, CO<sub>2</sub> sequestration, continuous processes, waste valorization, catalytic processes, bioengineering, pharmaceutical manufacturing, supercritical CO<sub>2</sub> 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

**Verified Synthesis of Zeolitic Materials** - H. Robson 2001-06-26

Zeolite synthesis is an active field of research. As long as this continues, new phases will be discovered and new techniques for preparing existing phases will appear. This edition of Verified Synthesis of Zeolitic Materials contains all the recipes from the first edition plus 24 new recipes. Five new introductory articles have been included plus those from the first edition, some of which have been substantially revised. The XRD patterns have been recorded using different instrument settings from those in the first edition and are intended to conform to typical X-ray diffraction practice. In most cases, only the XRD pattern for the product as synthesised is printed here. The exceptions are those phases which show marked changes in the XRD pattern upon calcination.

**Chemistry of Silica and Zeolite-Based Materials** - Abderrazzak Douhal 2019-07-04

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

**The Role of Catalysis for the Sustainable Production of Bio-fuels and Bio-chemicals** - Kostas Triantafyllidis 2013-03-19

The Role of Catalysis for the Sustainable Production of Bio-fuels and Bio-chemicals describes the importance of catalysis for the sustainable production of biofuels and biochemicals, focused primarily on the state-of-the-art catalysts and catalytic processes expected to play a decisive role in the "green" production of fuels and chemicals from biomass. In addition, the book includes general elements regarding the entire chain of biomass production, conversion, environment, economy, and life-cycle assessment. Very few books are available on catalysis in production schemes using biomass or its primary conversion products, such as bio-oil and lignin. This book fills that gap with detailed discussions of: Catalytic pyrolysis of lignocellulosic biomass Hybrid biogasoline by co-processing in FCC units Fischer-Tropsch synthesis to biofuels (biomass-to-liquid process) Steam reforming of bio-oils to hydrogen With energy prices rapidly rising, environmental concerns growing, and regulatory apparatus evolving, this book is a resource with tutorial, research, and technological value for chemists, chemical engineers, policymakers, and students. Includes catalytic reaction mechanism schemes and gives a clear understanding of catalytic processes Includes flow diagrams of bench-, pilot- and industrial-scale catalytic processing units and demonstrates the various process technologies involved, enabling easy selection of the best process Incorporates many tables, enabling easy comparison of data based on a critical review of the available literature

**Catalysis for Clean Energy and Environmental Sustainability** - K. K. Pant 2021-05-13

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.

**Encapsulated Catalysts** - Samahe Sadjadi 2017-06-08

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 *Nanoparticle Design and Characterization for Catalytic Applications in Sustainable Chemistry* - Rafael

Luque 2019-10-05

This book presents an introduction to the preparation and characterisation of nanomaterials and their design for specific catalytic applications.

**Zeolites and Zeolite-like Materials** - Bert Sels 2016-07-29

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

**Encyclopedia of Renewable and Sustainable Materials** - 2020-01-09

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 (CO<sub>2</sub>) 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

**Advanced Functional Solid Catalysts for Biomass Valorization** - Chaudhery Mustansar Hussain 2020-05-29

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.

**Green Chemistry** - Bela Torok 2017-11-07

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

**Hydrocarbon Chemistry, 2 Volume Set** - George A. Olah 2017-10-02

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)

**Structure and Reactivity of Metals in Zeolite Materials** - Joaquín Pérez Pariente 2018-09-12

This volume provides the reader with the most up-to-date and relevant knowledge on the reactivity of metals located in zeolite materials, either in framework or extra-framework positions, and the way it is connected with the nature of the chemical environment provided by the host. Since the first report of the isomorphous substitution of titanium in the framework of zeolites giving rise to materials with unusual catalytic properties, the incorporation of many other metals have been investigated with the aim for developing catalysts with improved performance in different reactions. The continuous expansion of the field, both in the variety of metals and zeolite structures, has been accompanied by an increasing focus on the relationship between the reactivity of metal centers and their unique chemical environment. The concepts covered in this volume are of interest to people working in the field of inorganic and physical chemistry, catalysis and chemical engineering, but also for those more interested in theoretical approaches to chemical reactivity. In particular the volume is useful to postgraduate students conducting research in the design, synthesis and catalytic performance of metal-containing zeolites in both academic and application contexts.

**Zeolite Synthesis** - Mario L. Occelli 1989

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.

**Zeolites in Catalysis** - Jiří Čejka 2017-06-07

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.

**Sustainable Solutions for Environmental Pollution, Volume 1** - Nour Shafik El-Gendy 2021-10-12

SUSTAINABLE SOLUTIONS FOR ENVIRONMENTAL POLLUTION This first volume in a broad, comprehensive two-volume set, Sustainable Solutions for Environmental Pollution, concentrates on the role of waste management in solving pollution problems and the value-added products that can be created out of waste, turning a negative into an environmental and economic positive. Environmental pollution is one of the biggest problems facing our world today, in every country, region, and even down to local landfills. Not just solving these problems, but turning waste into products, even products that can make money, is a huge game-changer in the world of environmental engineering. Finding ways to make fuel and other products from solid waste, setting a course for the production of future biorefineries, and creating a clean process for generating fuel and other products are just a few of the topics covered in the groundbreaking new first volume in the two-volume set, Sustainable Solutions for Environmental Pollution. The valorization of waste, including the creation of biofuels, turning waste cooking oil into green chemicals, providing sustainable solutions for landfills, and many other topics are also covered in this extensive treatment on the state of the art of this area in environmental engineering. This groundbreaking new volume in this forward-thinking set is the most comprehensive coverage of all of these issues, laying out the latest advances and addressing the most serious current concerns in environmental pollution. Whether for the veteran engineer or the student, this is a must-have for any library. AUDIENCE Petroleum, chemical, process, and environmental engineers, other scientists and engineers working in the area of environmental pollution, and students at the university and graduate level studying these areas

**Heterogeneous Catalysts** - Wey Yang Teoh 2021-02-23

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.

**Heterogeneous Catalysis for Sustainable Energy** - Landong Li 2022-05-03

Heterogeneous Catalysis for Sustainable Energy Explore the state-of-the-art in heterogeneous catalysis In Heterogeneous Catalysis for Sustainable Energy, a team of distinguished researchers delivers a comprehensive and cutting-edge treatment of recent advancements in energy-related catalytic reactions and processes in the field of heterogeneous catalysis. The book includes extensive coverage of the hydrogen economy, methane activation, methanol-to-hydrocarbons, carbon dioxide conversion, and biomass conversion. The authors explore different aspects of the technology, like reaction mechanisms, catalyst synthesis, and the commercial status of the reactions. The book also includes: A thorough introduction to the hydrogen economy, including hydrogen production, the reforming of oxygen-containing chemicals, and advances in Fischer-Tropsch Synthesis Comprehensive explorations of methane activation, including steam and dry reforming of methane and methane activation over zeolite catalysts Practical discussions of alkane activation, including cracking of hydrocarbons to light olefins and catalytic dehydrogenation of light alkanes In-depth examinations of zeolite catalysis and carbon dioxide as C1 building block Perfect for catalytic, physical, and surface chemists, Heterogeneous Catalysis for Sustainable Energy also belongs in the libraries of materials scientists with an interest in energy-related reactions and processes in the field of heterogeneous catalysis.

*Environmentally Friendly Zeolites* - Rafael Chaves Lima 2019

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.

**Nanoparticle Design and Characterization for Catalytic Applications in Sustainable Chemistry** - Rafael Luque 2019-05-10

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.

**Green Chemistry and Catalysis** - R. A. Sheldon 2007-06-27

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 CO<sub>2</sub> · 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.

**MWW-Type Titanosilicate** - Peng Wu 2013-08-04

This book provides a comprehensive review of a new generation of selective oxidation titanosilicate catalysts with the MWW topology (Ti-MWW) based on the research achievements of the past 12 years. It

gives an overview of the synthesis, structure modification and catalytic properties of Ti-MWW. Ti-MWW can readily be prepared by means of direct hydrothermal synthesis with crystallization-supporting agents, using dual-structure-directing agents and a dry-gel conversion technique. It also can be post-synthesized through unique reversible structure transformation and liquid-phase isomorphous substitution. The structural conversion of Ti-MWW into the materials usable for processing large molecules is summarized. Taking advantage of the structure diversity of the lamellar precursor of Ti-MWW, it can be fully or partially delaminated, and undergo interlayer silylation to obtain a novel structure with larger porosity. In the selective oxidation (alkene epoxidation and ketone/aldehyde ammoximation) with hydrogen peroxide or organic peroxide as an oxidant, the unique catalytic properties of Ti-MWW are described in comparison to conventional titanosilicates such as TS-1 and Ti-Beta.

*Nanoporous Materials* - Nick Kanellopoulos 2016-04-19

Having successfully replaced elements used in traditional, pollution-prone, energy-consuming separation processes, nanoporous materials play an important role in chemical processing. Although their unique structural or surface physicochemical properties can, to an extent, be tailored to meet specific process-related requirements, the task of charac

**Chemistry of Zeolites and Related Porous Materials** - Ruren Xu 2009-05-29

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.

**Mesoporous Zeolites** - Javier García-Martínez 2015-05-26

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.

*Heterogeneous Catalysis in Sustainable Synthesis* - Bela Torok 2021-09-17

Heterogeneous Catalysis in Sustainable Synthesis is a practical guide to the use of solid catalysts in synthetic chemistry that focuses on environmentally benign applications. Collating essential information on solid catalysts into a single volume, it reveals how the efficient use of heterogeneous catalysts in synthetic chemistry can support sustainable applications. Beginning with a review of the fundamentals of heterogeneous catalytic synthesis, the book then explores the basic concepts of heterogeneous catalytic reactions from adsorption to catalyst poisons, the use of non-traditional activation methods, recommended solvents, the major types of both metal and non-metal solid catalysts, and applications of these catalysts in sustainable synthesis. Based on the extensive experience of its expert author, this book aims to encourage and support synthetic chemists in using solid catalysts in their own work, while also highlighting the important link between heterogeneous catalysis and sustainability to all those interested. Combines foundational knowledge with a focus on practical applications Organizes information by reaction type, allowing readers to easily find examples of how to carry out specific reaction types with solid catalysts Highlights emerging areas such as nanoparticle catalysis and metal-organic framework (MOF) based catalysts

**Zeolites and Catalysis** - Jiri Cejka 2010-05-27

This indispensable two-volume handbook covers everything on this hot research field. The first part deals with the synthesis, modification, characterization and application of catalytic active zeolites, while the second focuses on such reaction types as cracking, hydrocracking, isomerization, reforming and other industrially important topics. Edited by a highly experienced and internationally renowned team with chapters written by the "Who's Who" of zeolite research.

**Structure and Reactivity of Metals in Zeolite Materials** - Joaquin Pérez-Pariente 2018

This volume provides the reader with the most up-to-date and relevant knowledge on the reactivity of metals located in zeolite materials, either in framework or extra-framework positions, and the way it is connected with the nature of the chemical environment provided by the host. Since the first report of the isomorphous substitution of titanium in the framework of zeolites giving rise to materials with unusual catalytic properties, the incorporation of many other metals have been investigated with the aim for developing catalysts with improved performance in different reactions. The continuous expansion of the field, both in the variety of metals and zeolite structures, has been accompanied by an increasing focus on the relationship between the reactivity of metal centers and their unique chemical environment. The concepts covered in this volume are of interest to people working in the field of inorganic and physical chemistry, catalysis and chemical engineering, but also for those more interested in theoretical approaches to chemical reactivity. In particular the volume is useful to postgraduate students conducting research in the design, synthesis and catalytic performance of metal-containing zeolites in both academic and application contexts.

Integrating Green Chemistry and Sustainable Engineering - Shahid Ul-Islam 2019-03-26

Over the past decade, the population explosion, rise in global warming, depletion of fossil fuel resources and environmental pollution has been the major driving force for promoting and implementing the principles of green chemistry and sustainable engineering in all sectors ranging from chemical to environmental sciences. It is noteworthy to mention that production of biofuels, exploitation of renewable energy sources and use of ecologically safer products in applied sectors are becoming increasingly important for the development of alternative sustainable technologies. Integrating Green Chemistry and Sustainable Engineering focusses on latest sustainable technologies and developments and describes how sustainable chemistry and engineering practices are being applied and integrated in various industrial sectors. The book addresses emerging topics including biofuel production, CO<sub>2</sub> conversion to green fuels, advanced green polymers in coating applications, biological macromolecules in medical sector, biofertilizers for agricultural sector, bioadsorption and much more.

*Heterogeneous Catalysis for Today's Challenges* - Brian Trewyn 2015-06-22

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.

**Nanotechnologies in Green Chemistry and Environmental Sustainability** - Samsul Ariffin Abdul Karim 2022-12-09

Nanotechnologies represent a fast-growing market and this unique volume highlights the current studies in applied sciences on sustainability of green science and technology. The chapters include modelling, machine learning, nanotechnology, nanofluids, nanosystems, smart materials and applications and solar and fuel cells technology. The authors cover simulation, additive manufacturing, machine learning and the autonomous system. Various aspects of green science as well as trans-disciplinary topics between fundamental science and engineering are presented. The book is suitable for all postgraduates and researchers working in this rapid growing research area. Features Presenting latest research on green materials and sustainability. Provide in depth discussion on modeling and simulation using latest techniques. Technical exposure for the readers on additive manufacturing principles. Numerous examples

on nanofluids and nano technology are presented. Discusses computer modeling, superconductivity, nanotubes and related structures such as graphene.

**Zeolites in Sustainable Chemistry** - Feng-Shou Xiao 2016-08-23

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.

**Nanosponges** - Francesco Trotta 2019-08-05

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.

**Bioenergy Systems for the Future** - Francesco Dalena 2017-06-19

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

Zeolites in Sustainable Chemistry - Feng-Shou Xiao 2015-09-28

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.

**Zeolites** - Karmen Margeta 2020-07-22

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.

*Inorganic Membranes: Synthesis, Characterization and Applications* - Reyes Mallada 2008-05-01

The withstanding properties of inorganic membranes provide a set of tools for solving many of the problems that the society is facing, from environmental to energy problems and from water quality to more competitive industries. Such a wide variety of issues requires a fundamental approach, together with the precise description of applications provided by those researchers that have been close to the industrial applications. The contents of this book expand the lectures given in a Summer School of the European Membrane Society. They combine an easily accessible description of the technology, suitable for the graduate level, with the most advanced developments and the prospective of future applications. The large variety of membrane types makes almost compulsory to select a specialist for each of them, and this has been the approach selected in this book. In the case of porous membranes, the advances are related to the synthesis of microporous materials such as silica, carbon and zeolite membranes and hollow fibre membranes. A chapter covers the increasingly relevant hybrid membranes. Attention is also devoted to dense inorganic membranes, experiencing constantly improved properties. The applications of all these membranes are considered throughout the book. Covers all the inorganic membranes field, by different experts It comes from a European Summer School It includes future directions in the field

**Sustainable Chemistry** - G. Reniers 2011

As the demands of society increase in their quest for safer, better and more convenient products, the chemical industry is faced on the one hand with the possible depletion of natural resources and on the other with a large share of responsibility for the damage that may be caused to the environment and the population by their products. The main area of chemical activity consists of the conversion of various base metals into substances and materials with new chemical and physical properties. A substantial amount of research is being carried out regarding this conversion process, which now must incorporate sustainability requirements. In addition, other associated activities, such as the chemical supply chain, performance measurements and different types of management tasks, must meet sustainability standards. Achieving sustainable chemistry based on clean processing routes, efficient use of resources, renewable materials, adequate management systems and other activities is not only essential for the future of a competitive chemical industry but also for a sustainable and healthy society and environment. Key to sustainable chemistry are innovative and cleaner technologies and the development of appropriate business models, performance measurements, and better integrated management. This book contains papers on the latest academic and industrial research in the field presented at the first international conference convened on the sustainable chemistry.