Deactivation And Regeneration Of Zeolite Catalysts

Principles of Adsorption and Adsorption Processes
Deactivation Routes in Zeolite Catalyzed Isobutane/2-Butene Alkylation and Regeneration Procedures
Catalyst Deactivation 1994
Catalysis for Clean Energy and Environmental Sustainability
Hydrocracking Science and Technology
Zeolite Microporous Solids: Synthesis, Structure, and Reactivity
Aspects of the Deactivation of H-ZSM-5 Zeolite in the Conversion of Methanol to Hydrocarbons
Structure and Reactivity of Metals in Zeolite Materials
Deactivation And Regeneration Of Zeolite Catalysts
Zeolites in Industrial Separation and Catalysis
Fine Chemicals through Heterogeneous Catalysis
Deactivation and Regeneration Procedures
Catalyst Deactivation

The proceedings of ZEOCAT 90 reflect the wide-ranging aspects of the rapidly expanding field of zeolite science and technology. The invited plenary lectures given by eminent zeolite scientists summarize current knowledge and address topical areas of zeolite research, including a contribution on the use of zeolites as membranes. The field of investigations described in the submitted articles in this volume covers a wide area of problems ranging from the influence of the synthesis process on the properties to questions of acidity, adsorption, diffusion, and catalysis. Of special interest are the newly developed applications of zeolites in the synthesis of fine chemicals, the use of zeolites for sensors and solid electrolytes, and the sophisticated zeolite-based separation processes.

Authoring 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.

Recent Advances in the Science and Technology of Zeolites and Related Materials

This first book to offer a practical overview of zeolites and their commercial applications provides a practical examination of zeolites in three capacities. Edited by a globally recognized and acclaimed leader in the field with contributions from major industry experts, this handbook and ready reference introduces such novel separators as zeolite membranes and mixed matrix membranes. The first part of the book discusses the history and chemistry of zeolites, while the second section focuses on separation processes. The third and final section treats zeolites in the field of catalysis. The three sections are unified by an examination of how the unique properties of zeolites allow them to function in different capacities as an adsorbent, a membrane and as a catalyst, while also discussing their impact within the industry.

In chemical processes, the progressive deactivation of solid catalysts is a major economic concern and mastering their stability has become as essential as controlling their activity and selectivity. For these reasons, there is a strong motivation to understand the mechanisms leading to any loss in activity and/or selectivity and to find out the efficient preventive measures and regenerative solutions that open the way towards cheaper and cleaner processes.
This book covers the fundamental and applied aspects of solid catalyst deactivation in a comprehensive way and encompasses the state of the art in the field of reactions catalyzed by zeolites. This particular choice is justified by the widespread use of molecular sieves in refining, petrochemicals and organic chemicals synthesis processes, by the large variety in the nature of their active sites (acid, base, acid-base, redox, bifunctional) and especially by their peculiar features, in terms of crystallinity, structural order and textural properties, which make them ideal models for heterogeneous catalysis. The aim of this book is to be a critical review in the field of zeolite deactivation and regeneration by collecting contributions from experts in the field which describe the factors, explain the techniques to study the causes and suggest methods to prevent (or limit) catalyst deactivation. At the same time, a selection of commercial processes and exemplar cases provides the reader with theoretical insights and practical hints on the deactivation mechanisms and draws attention to the key role played by the loss of activity on process design and industrial practice.

Bioenergy Resources and Technologies presents advanced approaches and applications of bioenergy resources, with a strong focus on environmental sustainability. Chapters on the applications of bioenergy, the implementation of bioenergy as an alternative fuel, and future energy security make this an invaluable and unique resource to further advance the field. This book provides new information and novel techniques across a variety of bioenergy applications, with the book's authors addressing key uses for bioenergy resources as an alternative fuel. Various case studies and examples help demonstrate meaning and provide additional clarity. Social and economic aspects are included for each technology discussed, along with a number of research works and their findings in a diverse mix of areas including energy, environmental science, biotechnology, chemical engineering and mechanical engineering. Researchers and professionals in these disciplines will gain knowledge on the underlying concepts, technologies, fuel applications and solutions to global environmental issues using bioenergy resources. Presents technical and social issues surrounding the latest bioenergy technologies Explores solutions to global sustainability goals through bioenergy applications and the future of energy security Includes experimental investigations of engine performance, emissions and combustion phenomena using different types of oxygenated fuel

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.

This book is a printed edition of the Special Issue "Advances in Catalyst Deactivation" that was published in Catalysts

The aim of this thesis was to understand the routes of deactivation of iso-butane / 2-butene alkylation on faujasitic zeolites and to correlate the alkylation performance with the physicochemical properties of the zeolite used. It was also under the scope of this thesis, to propose a reaction/regeneration mechanism that ensures a successful and continuous operation. It could be shown that the avoidance of structural damage occurring during the modification procedure is the key factor for suitable alkylation catalyst. A successful catalyst for alkylation has to posses a high concentration of strong Bronsted acid sites and a low concentration of Lewis acid sites. It could be shown that during the alkylation reaction a high quality alkylate was produced that was practically free of unsaturated compounds and aromatics, even at times close to deactivation. It could be shown that the accumulated deposits in the pores of the catalyst were mainly formed by highly branched paraffinic compounds following a (CH2)3 series and with molecular weights from 128 g/mol to 548 g/mol. The deposits formed inside the pores of the catalyst were a result of propene oligomerization. Superior catalysts showed lower masses in the deposits with a maximum at C12-C15 while inferior catalysts showed a maximum at C24-C27. Low amounts of olefins and aromatics were also found in the deposits. Small amounts of C12H26 and C16H34 from multiple alkylation were also detected in the deposits. Cyclic compounds and aromatics were formed on the surface of the catalyst as observed by MALDI-TOF. These types of compounds were not detected when the zeolite was dissolved in HF and the coke molecules extracted with methylene chloride. Therefore, their concentration was low within the total concentration of deposits. These types of
molecules were responsible for pore mouth plugging on the surface of the catalyst. The size of the molecules detected by MALDI-TOF increased with time-on-stream for all catalyst. They w.

Presented in an easy-to-read form, this book on zeolite catalysis cover all aspects of the subject. It focuses on synthesis, structure, diffusion, deactivation, and industrial applications. This book is an ideal text for courses on catalysis or as a supplementary text for those studying applied or industrial chemistry. It is also a useful resource for anyone who works with zeolites as catalysts in the laboratory, pilot plants, or commercial installations.

Advances in Nanoporous Materials is a collection of comprehensive reviews of lasting value to the field. The contributions cover all aspects of nanoporous materials, including their preparation and structure, post-synthetic modification, characterization and use in catalysis, adsorption/separation, and all other fields of potential application, e.g., membranes, host/guest chemistry, environmental protection, electrochemistry, sensors, and optical devices.

"Nanoporous materials" comprise all kinds of porous solids that possess pores in the range from about 0.2 nm up to 50 nm, irrespective of their chemical composition, their origin (natural or synthetic), and their amorphous or crystalline nature. Typical examples are zeolites and zeolite-like materials (e.g., crystalline microporous aluminophosphates and their derivatives), mesoporous oxides such as silica, metal organic frameworks, pillared clays, porous carbons, and related materials. State-of-the-art reviews keep coverage current Broad scope provides a full topical overview Contributions from renowned experts lend authority to the material

This Proceedings of APCRE'05 contains the articles that were presented at the 4th Asia-Pacific Chemical Reaction Engineering Symposium (APCRE'05), held at Gyeongju, Korea between June 12 and June 15, 2005, with a theme of "New Opportunities of Chemical Reaction Engineering in Asia-Pacific Region". Following the tradition of APCRE Symposia and ISCRE, the scientific program encompassed a wide spectrum of topics, including not only the traditional areas but also the emerging fields of chemical reaction engineering into which the chemical reaction engineers have successfully spearheaded and made significant contributions in recent years. In addition to the 190 papers being accepted, six plenary lectures and 11 invited lectures are placed in two separate chapters in the front. * Provides an overview of new developments and application in chemical reaction engineering * Topics include traditional and emerging fields * Papers reviewed by experts in the field

Presents advances in the field of hydrocracking. The volume includes catalytic materials, reaction mechanisms and pathways, as well as hydrocracking processes and applications. It discusses hydrocracking processes and hydrocracking technology in catalytic dewaxing, resid upgrading, and fluid catalytic cracking feedstock improvement

In chemical processes, the progressive deactivation of solid catalysts is a major economic concern and mastering their stability has become as essential as controlling their activity and selectivity. For these reasons, there is a strong motivation to understand the mechanisms leading to any loss in activity and/or selectivity and to find out the efficient preventive measures and regenerative solutions that open the way towards cheaper and cleaner processes. This book offers a comprehensive way both the fundamental and applied aspects of solid catalyst deactivation and encompasses the state-of-the-art in the field of reactions catalyzed by zeolites. This particular choice is justified by the widespread use of molecular sieves in refining, petrochemicals and organic chemicals synthesis processes, by the large variety in the nature of their active sites (acid, base, acid-base, redox, bifunctional) and especially by their peculiar features, in terms of crystallinity, structural order and textural properties, which make them ideal models for heterogeneous catalysis. The aim of this book is to be a critical review in the field of zeolite deactivation and regeneration, by collecting a series of contributions by experts in the field which describe the factors, explain the techniques to study the causes and suggest methods to prevent (or limit) catalyst deactivation. At the same time, an anthology of commercial processes and exemplar cases provides the reader with theoretical insights and practical hints on the deactivation mechanisms and draws attention to the key role played by the loss of activity on process design and industrial practice.

The first up-to-date summary and review for the fundamental principles and industrial practice of adsorption separation processes in more than 30 years. Emphasizes the understanding of adsorption column dynamics and the modeling of adsorption systems, as well as fundamental aspects of kinetics and equilibria.

The Frontiers in Materials Editorial Office team are delighted to present the second edition of the "Rising Stars" article collection, "Frontiers in Materials: Rising Stars 2020", showcasing the high-quality work of internationally recognized researchers in the early stages of their independent careers. All Rising Star researchers featured within
Intensive research on zeolites, during the past thirty years, has resulted in a deep understanding of their chemistry and in a true zeolite science, including synthesis, structure, chemical and physical properties, and catalysis. These studies are the basis for the development and growth of several industrial processes applying zeolites for selective sorption, separation, and catalysis. In 1983, a NATO Advanced Study Institute was organized in Alcabideche (Portugal) to establish the State-of-the-Art in Zeolite Science and Technology and to contribute to a better understanding of the structural properties of zeolites, the configurational constraints they may exert, and their effects in adsorption, diffusion, and catalysis. Since then, zeolite science has witnessed an almost exponential growth in published papers and patents, dealing with both fundamentals issues and original applications. The proposal of new procedures for zeolite synthesis, the development of novel and sophisticated physical techniques for zeolite characterization, the discovery of new zeolitic and related microporous materials, progresses in quantum chemistry and molecular modeling of zeolites, and the application of zeolites as catalysts for organic reactions have prompted increasing interest among the scientific community. An important and harmonious interaction between various domains of Physics, Chemistry, and Engineering resulted therefrom.

This book presents a collection of studies on state-of-art techniques for converting biomass to chemical products by means of pyrolysis, which are widely applicable to the valorization of biomass. In addition to discussing the fundamentals and mechanisms for producing bio-oils, chemicals, gases and biochar using pyrolysis, it outlines key reaction parameters and reactor configurations for various types of biomass. Written by leading experts and providing a broad range of perspectives on cutting-edge applications, the book is a comprehensive reference guide for academic researchers and industrial engineers in the fields of natural renewable materials, biorefinery of lignocellulose, biofuels, and environmental engineering, and a valuable resource for university students in the fields of chemical engineering, material science and environmental engineering.

Zeolites are the most frequently used industrial catalysts. Their applications range from oil refining, petrochemistry and the synthesis of special chemicals to environmental catalysis. Rapid progress in basic research and the development of new processes has resulted in the first Federation of European Zeolite Associations (FEZA) School on Zeolites, Zeolites and Ordered Mesoporous Materials: Progress and Prospects reflects the programme of the first School on Zeolites, held in Prague on August 20-21, 2005. Readers gain insight into the synthesis of the ever-expanding spectrum of zeolites, zeotypes and ordered mesoporous materials including the use of zeolites and mesoporous materials as catalysts in organic conversions. These range from the fascinating ship-in-bottle systems via cascade reactions to bulk applications in oil-refining and petrochemistry. Contributions from world experts enhance the book, with select chapters on trends in the molecular sieves field, zeolite structures, ion-exchange properties of zeolites, advanced applications (with unique technologies and opportunities) and a chapter on natural zeolites. * Contains contributions from world experts in the field * Includes an account of the frontier topic of high-throughput techniques * Reviews the application of quantum-chemical methods to zeolite science to show the necessity of combining experimental and theoretical approaches

The proceedings of this zeolite scientific meeting reflect the growing drive to discover new materials. It is evident that zeolite materials science is in a post-ZSM-5 period - pushed by a massive expansion of new compositions and topologies, and the application of new scientific tools. Four new zeolite topologies were detailed at this meeting. Important new trends were the resurgence of interest in computational and theoretical approaches to explain synthesis, sorption and catalytic data, and the increasing use of NMR and high-resolution imaging.

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
Deactivation and Poisoning of Catalysts presents the most current research in the area of heterogeneous catalysis. It focuses on the chemically induced effects associated with bonded surface species that cause catalyst activity decline -- and in some cases a change in catalyst specificity. In addition, this volume examines poisoning of dispersed metal catalysts the thermodynamics of sulfur-metal and carbon-metal interactions model poisoning reactions on single crystals deactivation in petroleum refining and petrochemical processes coking of metal catalysts and more. The new approaches and solutions to catalyst deactivation and poisoning presented in this guide are invaluable to all heterogeneous catalysis specialists, including chemical and petroleum engineers, and surface, synthetic, physical, and industrial chemists. Book jacket.

Nowadays, the chemical industry is under increased pressure to develop cleaner production processes and technologies. Much effort is devoted to the development of heterogeneous catalysts and their application in industrial-scale organic synthesis. This handbook concentrates on current attempts, focusing on fine chemical production. With contributions from an impressive array of international experts, this is essential reading for everyone interested in the advances in this field.

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chapters are contributed by industrial researchers and technicians and address various petrochemical processes, including hydrotreating, hydrocracking, flue gas treatment and isomerization catalysts.

The Proceedings of the 15th International Zeolite Conference contain 291 full papers, including the full papers of 5 plenary lecture, 12 keynote lectures, and 4 invited lectures at the R. M. Barrer Symposium. The topics of these full papers include synthesis, modifications, structures, characterization, adsorption, separation and diffusion, catalysis, host-guest chemistry and advanced materials, industrial applications, theory and modeling, mesostructured materials, MOF materials, and natural zeolites. The other 271 full papers were selected from the about 1000 contributions submitted to the 15th IZC. - Most recent research results in zeolite science - Full indexes - Wide coverage of zeolite science and technology

Catalyst lifetime represents one of the most crucial economic aspects in industrial catalytic processes, due to costly shutdowns, catalyst replacements, and proper disposal of spent materials. Not surprisingly, there is considerable motivation to understand and treat catalyst deactivation, poisoning, and regeneration, which causes this research topic to continue to grow. The complexity of catalyst poisoning obviously increases along with the increasing use of biomass/waste-derived/residual feedstocks and with requirements for cleaner and novel sustainable processes. This book collects 15 research papers providing insights into several scientific and technical aspects of catalyst poisoning and deactivation, proposing more tolerant catalyst formulations, and exploring possible regeneration strategies.

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.

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), hierarchic 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

Advanced Nanomaterials for Catalysis and Energy: Synthesis, Characterization and Applications outlines new approaches to the synthesis of nanomaterials (synthesis in flow conditions, laser electrodispersion of single metals or alloys on carbon or oxide supports, mechanochemistry, sol-gel routes, etc.) to provide systems with a narrow particle size distribution, controlled metal-support interaction and nanocomposites with uniform spatial distribution of domains of different phases, even in dense sintered materials. Methods for characterization of real structure and surface properties of nanomaterials are discussed, including synchrotron radiation diffraction and X-ray photoelectron spectroscopy studies, neutronography, transmission/scanning electron microscopy with elemental analysis, and more. The book covers the effect of nanosystems' composition, bulk and surface properties, metal-support interaction, particle size and morphology, deposition density, etc. on their functional properties (transport features, catalytic activity and reaction mechanism). Finally, it includes examples of various developed nanostructured solid electrolytes and mixed ionic-electronic conductors as materials in solid oxide fuel cells and asymmetric supported membranes for oxygen and hydrogen separation. Outlines synthetic and characterization methods for nanocatalysts Relates nanocatalysts’ properties to their specific applications Proposes optimization
methods aiming at specific applications

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