

Zeolite Type Crystal Structures And Their Chemistry Framework Type Codes Sto To Zon Vol 14 Microporous And Other Framework Materials With In Science And Technology New Series

Zeolites form a family of minerals which have been known since the 18th century, but they remained a curiosity for scientists and collectors until 60 years ago, when their unique physicochemical properties attracted the attention of many researchers. In the past 30 years there has been an ex traordinary development in zeolite science: several international symposia have been held every 3 years since 1967, and a large number of interesting contributions have been published in their proceedings. Many books, written either by individual authors or by several authors under a leading editor, have been published on these interesting silicate phases, but none has been devoted specifically to natural zeolites, even though they are of interest not only to earth scientists, but also to chemists, as the information obtained from natural samples completes and in tegrates the characterization of many zeolites. We are trying to fill this gap on the basis of 20 years of research on natural zeolites, which we performed at the University of Modena together with many friends and colleagues. This book with out upsetting somebody, this is particularly true for a book on natural crystals, because mineralogy is an interdisciplin ary science which covers some fields of physics, chemistry, it is almost impossible to meet every petrology, geology, and requirement.

Zeolite scientists, whether they are working in synthesis, catalysis, characterization or application development, use the Atlas of Zeolite Framework Types as a reference. It describes the main features of all of the confirmed zeolite framework structures, and gives references to the relevant primary structural literature. Since the last edition in 1983, the Atlas has been approved and are described in this new edition. A further new feature will be that characteristic building units will be listed for each of the framework types. Zeolites and their analogs are used as desiccants, as water softeners, as shape-selective acid catalysts, as molecular sieves, as concentrators of radioactive isotopes, as blood clotting agents, as ion-exchanging softening agents for detergents, as separation, medicine, and pharmacy, are known, making zeolites almost a necessity of daily life. Consequently, there are many, research activities dealing with zeolites properties and characterization. However, a strictly systematic description of zeolite-type crystal structures was not available but is now presented in this series of volumes. Recently, their suitability as hosts for nanometer spacing of atomic clusters has also been demonstrated. These diverse applications are a reflection of the fascinating structures of these microporous materials. Each time a new zeolite framework structure is reported, it is examined by the Structure Commission of the International Zeolite Association. The Atlas of Zeolite Framework Types is essentially a compilation of data for each of these confirmed framework types. These data include a stereo drawing of the framework structure, a list of materials with this framework type, information on the type material that was used to establish the framework type, and stereo drawings of the pore openings of the type material. * Clear stereo drawings of each of the framework types * Description of the features of each framework type see if the framework type is suitable to their needs * References to isotypic materials, readers can quickly identify related materials and consult the appropriate reference

Zeolites and zeolite-like became important because of their ion exchange capacities and their outstanding catalytic properties. Millions of tons of zeolites have been produced in the past years for the oil refining industry alone and, in even greater quantities, as ion-exchanging softening agents for detergents. Numerous other applications, 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.

The essential introduction to the understanding of the structure of inorganic solids and materials. This revised and updated 2nd Edition looks at new developments and research results within Structural Inorganic Chemistry in a number of ways, special attention is paid to crystalline solids, elucidation and description of the spatial order of atoms and molecules. Structural principles of inorganic molecules and solids are described through traditional concepts, modern bond-theoretical theories, as well as taking symmetry as a leading principle.

Zeolite-Type Crystal Structures and their Chemistry. 25 New Framework Type Codes and Supplements for Vols. B to G

Clathrate Hydrates, 2 Volumes

Zeolite-Type Crystal Structures and their Chemistry. 41 New Framework Type Codes

Properties and Applications

Structure and Reactivity of Modified Zeolites

Inorganic oxyalts are chemical compounds that contain oxygen - the most abundant element in the Earth's core. Their atomic arrangement (crystal structure) has a dramatic influence upon their properties and, as a consequence, upon the inorganic part of the world around us. This book is the first systematic survey of structures of inorganic oxyalts considered to date. It presents the viewpoint of modern scientific methods of description and visualization of complex atomicarrangements. Relates how to remove contaminants from effluent streams. The book discusses separation of environmental pollutants - enriching, stripping, clarification, beneficiation, remediation, removal, concentration, purification, and more - and critiques both tried-and-true and newer methods. It covers classical as well as newly emerging means of separating industrial wastes and by-products from environmental streams.

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 bed ion-exchange resins, zeolite-based membranes, and zeolite-based 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, as a membrane and as a catalyst, while also discussing their impact within the industry.

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.

The Third International Conference Co-sponsored by the Eidgenössische Technische Hochschule and The Swiss Chemical Society at Zurich, Switzerland W.M. Meier ..., Eds

Mullite

New Developments in Adsorption/Separation of Small Molecules by Zeolites

Science of Crystal Structures

Synthesis, Characterization and Catalytic Applications

Zeolites and zeolite-like materials became important because of their ion exchange capacities and their outstanding catalytic properties. Millions of tons of zeolites have been produced in the past years for the oil refining industry alone and, in even greater quantities, as ion-exchanging softening agents for detergents.

Numerous other applications, e.g., in environmental protection, farming, gas separation, medicine, and pharmacy, are known, making zeolites almost a necessity for daily life. Consequently, there are many research activities dealing with zeolite properties and characterization. However, a strictly systematic description of zeolite-type crystal structures was not available but is now presented in this series of volumes. It is designed as a reference work for zeolite chemists and materials scientists, but it also serves as a tool to interpret structural similarities and to derive new structures from known topologies.

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.

The atlas contains an entry for each unique zeolite framework type. The term zeolite framework refers to a corner-sharing network of tetrahedrally coordinated atoms. This 5th edition is again an updated version of the previous compilation, and the number of entries has risen significantly to 133.

The only book to provide a complete survey -- from the crystallographic fundamentals right up to recent high-tech applications in aerospace technology. Following a general introduction to the topic, the authors go on to cover the crystal chemistry of mullite and related phases, as well as its basic properties, phase equilibria and stability. One whole section is devoted to the synthesis and processing of mullite ceramics, while later ones cover mullite coatings, fibers and matrix composites. For materials scientists, solid state chemists and physicists, crystallographers and mineralogists.

Highlights in Applied Mineralogy

Occurrence, Properties, Applications

Zeolite Microporous Solids: Synthesis, Structure, and Reactivity

Zeolites in Sustainable Chemistry

Tetrahedral Frameworks of Zeolites, Clathrates and Related Materials

Although ceramics have been known to mankind literally for millennia, research has never ceased. Apart from the classic uses as a bulk material in pottery, construction, and decoration, the latter half of the twentieth century saw an explosive growth of application fields, such as electrical and thermal insulators, wear-resistant bearings, surface coatings, lightweight armour, or aerospace materials. In addition to plain, hard solids, modern ceramics come in many new guises such as fabrics, ultrathin films, microstructures and hybrid composites. Built on the solid foundations laid down by the 20-volume series Materials Science and Technology, Ceramics Science and Technology picks out this exciting material class and illuminates it from all sides. Materials scientists, engineers, chemists, biochemists, physicists and medical researchers alike will find this work a treasure trove for a wide range of ceramics knowledge from theory and fundamentals to practical approaches and problem solutions.

A volume which includes entries on quasicrystals, icosahedral packing, other packing considerations, extended structures, data treatment and data mining is presented by luminaries from the crystallography community. Several of the contributions are from the schools of such trend-setting crystallographers as J. Desmond Bernal and Aleksandr I. Kitaigorodskii. Internationally renowned scientists contributed such as Tom L. Blundell, Johann Jacob Burckhardt, John L. Finney, Jenny P. Glusker, Nobel laureate Herbert A. Hauptman, the 2014 Ewald-Prize winner A. Janner, Aminoff-Prize winner Isabella Karle, Nobel laureate Jerome Karle, Buckley-Prize winner Alan L. Mackay, Ewald-Prize winner David Sayre, Vladimir Shevchenko, and J. Fraser Stoddart. A few frontier topics dominate the selected material. Pioneers of the direct methods describe the phase problem and how it was solved, including the mathematical approach and the utilization of experience with gas-phase electron diffraction. The reviews by Herbert Hauptman, Jerome and Isabella Karle, and David Sayre reach to the present day in assessing the possibilities of X-ray crystallography. Another focus topic is the investigation of systems that are outside the so-called classical system of crystals. They include quasicrystals, imperfect and very small crystals, supramolecular species, crystal structures without lattice, clusters, nanomaterials among others. Application of synchrotron and cryoprotection techniques, the free-electron laser flash technique and others are mentioned in addition to X-ray crystallography. The relationship between structural and materials properties are examined and uncovered. The broader topics of the so-called generalized crystallography include polymers, clusters, polydisperse chain assemblies, and giant icosahedral fullerenes. There are some key contributions related to the structural investigation of biological macromolecules.

This book shows the promising future and essential issues on the storage of the supercritical gases, including hydrogen, methane and carbon dioxide, by adsorption with controlling the gas-solid interaction by use of designed nanoporous materials. It explains the reason why the storage of these gases with adsorption is difficult from the fundamentals in terms of gas-solid interaction. It consists of 14 chapters which describe fundamentals, application, key nanoporous materials (nanoporous carbon, metal organic frame works, zeolites) and their storage performance for hydrogen, methane, and carbon dioxide. Thus, this book appeals to a wide readership of the academic and industrial researchers and it can also be used in the classroom for graduate students focusing on clean energy technology, green chemistry, energy conversion and storage, chemical engineering, nanomaterials science and technology, surface and interface science, adsorption science and technology, carbon science and technology, metal organic framework science, zeolite science, nanoporous materials science, nanotechnology, environmental protection, and gas sensors.

What can we learn from nature? The study of the physical, chemical and structural properties of well-known minerals in the geo- and biosphere creates new opportunities for innovative applications in technology, environment or medicine. This book highlights today's research on outstanding minerals such as garnets used as components in all solid state batteries, delafossite formation during wastewater treatment, monazites for the immobilization of high level radioactive waste or hydroxylapatite as bioactive material for medical implant applications. Contents Part I: High-technology materials Lithium ion-conducting oxide garnets Olivine-type battery materials Natural and synthetic zeolites Microstructure analysis of chalcopyrite-type CuInSe2 and kesterite-type Cu2ZnSnSe4 absorber layers in thin film solar cells Surface-engineered silica via plasma polymer deposition Crystallographic symmetry analysis in NiTi shape memory alloys Part II: Environmental mineralogy Gold, silver, and copper in the geosphere and anthroposphere: can industrial wastewater act as an anthropogenic resource? Applied mineralogy for recovery from the accident of Fukushima Daiichi Nuclear Power Station Phosphates as safe containers for radionuclides Immobilization of high-level waste calcine (radwaste) in perovskites

Titanate ceramics for high-level nuclear waste immobilization Part III: Biomineralization, biomimetics, and medical mineralogy Patterns of mineral organization in carbonate biological hard materials Sea urchin spines as role models for biological design and integrative structures Nacre: a biomineral, a natural biomaterial, and a source of bio-inspiration Hydroxylapatite coatings: applied mineralogy research in the bioceramics field A procedure to apply spectroscopic techniques in the investigation of silica-bearing industrial materials

Zeolite-Type Crystal Structures and their Chemistry. Framework Type Codes STO to ZON

Proceedings of the 14th International Zeolite Conference, Cape Town, South Africa, 25-30th April 2004

Atlas of Zeolite Framework Types (formerly: Atlas of Zeolite Structure Types)

Separation Methods for Waste and Environmental Applications

Molecular Science and Characterization

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

This 5th edition of the Zeolite Powder Pattern Collection contains calculated patterns of 218 zeolite materials representing 174 framework topologies. The almost exponential growth of new zeolite topologies reflects the continued success of zeolite synthesis researchers in producing novel materials. Collection of Simulated XRD Powder Patterns for Zeolites includes materials of interest to zeolite scientists following the policies established at recent IZA conferences. The materials included have corner-sharing tetrahedral frameworks with no restrictions on chemical composition. Covers an increase of 41 new topologies since the 4th edition in 2001 Data collected from diverse literature sources Represents an extensive compilation of data

Structure and Reactivity of Modified Zeolites

In view of the substantial progress made in the last decade in the fields of zeolites and related materials it was decided to go for an extended 2nd Edition of "Introduction to Zeolite Science and Practice". Unfortunately - as often is the case - this process took more time than expected by the Editors. In the mean time some new texts on zeolites were issued. Nevertheless, the combination of data, discussion and dedication provided by the present book is a unique coverage of the field, in the opinion of the Editors. In the present Edition the number of chapters rose from 16-22. The contributions can be divided into three categories: updated chapters by the original authors, updated chapters by an expanded or new team of authors and completely new chapters. This 2nd Edition also contains new chapters on "Zeolite-based supramolecular assemblies" (by Dirk De Vos and Pierre Jacobs, experts in this area) and on "The use of bulky probe molecules" (by Paul Kunkeler, Roger Downing and one of the Editors). Finally, the super large pore zeolites and the fast growing area of ordered mesoporous materials are dealt with by Eelco Vogt, Charlie Kresge and and Jim Vartuli. The latter two authors belong to the discoverers of the M41S family of mesoporous materials.

Zeolite-Type Crystal Structures and their Chemistry., Framework Type Codes DAC to LOV

Numerical Data and Functional Relationships in Science and Technology

Bibliography

Micro- and Mesoporous Mineral Phases

Volume 57 of Reviews in Mineralogy and Geochemistry highlights the present knowledge on micro- and mesoporous mineral phases, with focus on their crystal-chemical aspects, occurrence and porous activity in nature and experiments. As zeolites are the matter of numerous ad hoc meetings and books - including two volumes in this series - they do not specifically appear in the present volume. The phases of the sodalite and cancrinite-dayne groups, which mineralogists consider distinct from zeolites, are instead considered (in the order, chapter 7 by W. Depmeier and part of chapter 8 by E. Bonaccorsi and S. Merlino, respectively).

This volume compiles and discusses the fundamental and multidisciplinary knowledge on adsorption and separation processes using zeolites as adsorbents. Over the last decade, a large amount of research has been carried out for the development of zeolites as adsorbents. However, there is still a growing interest to increase the understanding of such selective adsorbents. Therefore, synthesis strategies and new approaches for developing new selective zeolite adsorbents for gas separation are presented in the first chapter. In addition, a chapter focused on adsorption characterization techniques of microporous materials is included. This will be helpful for advanced readers, since the new IUPAC recommendations for microporous characterization are not still widely employed by the zeolite community. Experimental and theoretical aspects of economically and environmentally relevant separations, which have been successfully carried out with zeolites, are discussed in detail in subsequent chapters. Finally, industrial zeolite based adsorption and separation processes as well as current perspectives for new zeolite based separations, and improvements of current technologies are presented.

Zeolite-Type Crystal Structures and their Chemistry. 41 New Framework Type CodesSpringer

Volume 45 of Reviews in Mineralogy and Geochemistry is a new and expanded update of Volume 4 from 1977. Most of the material in this volume is entirely new, and Natural Zeolites: Occurrence, Properties, Applications presents a fresh and expanded look at many of the subjects contained in Volume 4. There has been an explosion in our knowledge of the crystal chemistry and structures of natural zeolites (Chapters 1 and 2), due in part to the now-common Rietveld method that allows treatment of powder diffraction data. Studies on the geochemistry of natural zeolites have also greatly increased, partly as a result of the interests related to the disposal of radioactive wastes, and Chapters 3, 4, 5, 13, and 14 detail the latest results in this important area. Until the latter part of the 20th century, zeolites were often looked upon as a geological curiosity, but they are now known to be widespread throughout the world in sedimentary and igneous deposits and in soils (Chapters 6-12). The application of natural zeolites has greatly expanded since the first zeolite volume. Chapter 15 details the use of natural zeolites for removal of ammonium ions, heavy metals, radioactive cations, and organic molecules from natural waters, wastewaters, and soils. Similarly, Chapter 16 describes the use

of natural zeolites as building blocks and cements in the building industry, Chapter 17 outlines their use in solar energy storage, heating, and cooling applications, and Chapter 18 describes their use in a variety of agricultural applications, including as soil conditioners, slow-release fertilizers, soil-less substrates, carriers for insecticides and pesticides, and remediation agents in contaminated soils.

Vol. 14: Microporous and other Framework Materials with Zeolite-Type Structures

Chemistry of Zeolites and Related Porous Materials

Environmental and Pharmaceutical Applications

Modified Clay and Zeolite Nanocomposite Materials

Highlights in Crystallography

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

By browsing about 10 000 000 scientific articles of over 200 major journals some 200 000 publications were selected. The extracted data is part of the following material research fields: crystal structures (S), phase diagrams (C) and intrinsic physical properties (P). These research field codes as well as the chemical systems investigated in each publication were included in the present work. The aim of this Bibliography is to provide researchers with a comprehensive compilation of all up to now published scientific publications on inorganic systems in only three handy volumes.

Zeolites and zeolite-like became important because of their ion exchange capacities and their outstanding catalytic properties. Millions of tons of zeolites have been produced in the past years for the oil refining industry alone and, in even greater quantities, as ion-exchanging softening agents for detergents. Numerous other applications, e.g. in environmental protection, farming, gas separation, medicine, and pharmacy, are known, making zeolites almost a necessity of daily life. Consequently, there are many, research activities dealing with zeolites properties and characterization. However, a strictly systematic description of zeolite-type crystal structures was not available but is now presented in this series of volumes. It is disigned as a reference work for zeolite chemists and materials scientists, but it also serves as a tool to interpret structural similarities and to derive new structures from known topologies.

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.

Natural Zeolites

Microporous and other Framework Materials with Zeolite-Type Structures

Atlas of Zeolite Framework Types

Nanoporous Materials for Gas Storage

Structures

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.

Modern Inorganic Synthetic Chemistry, Second Edition captures, in five distinct sections, the latest advancements in inorganic synthetic chemistry, providing materials chemists, chemical engineers, and materials scientists with a valuable reference source to help them advance their research efforts and achieve breakthroughs. Section one includes six chapters centering on synthetic chemistry under specific conditions, such as high-temperature, low-temperature and cryogenic, hydrothermal and solvothermal, high-pressure, photochemical and fusion conditions. Section two focuses on the synthesis and related chemistry problems of highly distinct categories of inorganic compounds, including superheavy elements, coordination compounds and coordination polymers, cluster compounds, organometallic compounds, inorganic polymers, and nonstoichiometric compounds. Section three elaborates on the synthetic chemistry of five important classes of inorganic functional materials, namely, ordered porous materials, carbon materials, advanced ceramic materials, host-guest materials, and hierarchically structured materials. Section four consists of four chapters where the synthesis of functional inorganic aggregates is discussed, giving special attention to the growth of single crystals, assembly of nanomaterials, and preparation of amorphous materials and membranes. The new edition's biggest highlight is Section five where the frontier in inorganic synthetic chemistry is reviewed by focusing on biomimetic synthesis and rationally designed synthesis. Focuses on the chemistry of inorganic synthesis, assembly, and organization of wide-ranging inorganic systems Covers all major methodologies of inorganic synthesis Provides state-of-the-art synthetic methods Includes real examples in the organization of complex inorganic functional materials Contains more than 4000 references that are all highly reflective of the latest advancement in inorganic synthetic chemistry Presents a comprehensive coverage of the key issues involved in modern inorganic synthetic chemistry as written by experts in the field

Clathrate Hydrates All-inclusive reference on clathrate hydrates from a molecular perspective Clathrate hydrates are crystalline water-based inclusion compounds many of which form at high pressures and low temperatures. Molecular science has provided the foundation for many areas of modern hydrate research and applications ranging from desalination processes to flow assurance in oil and gas pipelines. Clathrate Hydrates provides detailed information on the molecular science aspects of hydrate research, covering the structural, compositional, spectroscopic, thermodynamic, and mechanical properties of clathrate hydrates as well as simulation methods and selected engineering applications. Edited and authored by recognized leaders in the field, this comprehensive resource introduces readers to clathrate hydrates and reviews the state-of-the-art of the field. In-depth chapters address different areas of specialization such as characterization of clathrate hydrates using NMR spectroscopy, infrared and Raman spectroscopy, and X-ray and neutron diffraction and scattering. Highlights recent developments in clathrate hydrate research and applications such as natural gas recovery, desalination, and gas separation Reviews various molecular simulation methods for characterizing clathrate hydrates, including quantum mechanical calculations and Monte Carlo results Contains tables of known guest molecules, summaries of structural and physical properties, and different classes of clathrate hydrate phase equilibria Introduces unconventional guest-host interactions, related non-hydrate clathrates, and space-filling cages using the Frank-Kasper approach Covers the molecular motion of guest and host molecules and the relationship between cage geometry and guest dynamics Presents the rate and mechanisms of hydrate formation and decomposition from both macroscopic and microscopic points Clathrate Hydrates: Molecular Science and Characterization is an indispensable reference for materials scientists, physical chemists, chemical engineers, geochemists, and graduate students in relevant areas of science and engineering.

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

Ceramics Science and Technology, Volume 1

Zeolite-Type Crystal Structures and Their Chemistry. Framework Type Codes LTA to RHO

Zeolites in Catalysis

Collection of Simulated XRD Powder Patterns for Zeolites Fifth (5th) Revised Edition

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

Synthesis and Structure

Molecular Sieves

Zeolite Structure Codes ABW to CZP

Structural Crystallography of Inorganic Oxyalts

Modern Inorganic Synthetic Chemistry