Book Reviews

Zeolites, Crystal Growth, Polymers and Miscellanea

Catalysis on Zeolites. Edited by *D. Kalló* and *Kh. M. Minachev*. Akadémiai Kiadó, Budapest 1988. xi, 583 pp., bound, DM 115.00.—ISBN 963 05 4559 x

During recent decades zeolites and related molecular sieve materials have proved remarkably successful in various branches of chemistry and chemical engineering. Perhaps the most striking progress has been achieved in the application of zeolites as catalysts. Important advantages of zeolites over more conventional porous solids are their high density and strength of acid sites, the availability of numerous techniques for chemical modifications, and their thermal stability. Moreover, with the advent of molecular sieve materials, the door was opened to shape-selective catalysis, which led to a number of new catalytic processes. Today, zeolites can be tailored for a wide variety of catalytic applications. It is therefore not surprising that catalysis on zeolites is among the major research topics in almost all industrialized countries. About 15 years ago, the European socialist countries, in an attempt to coordinate and intensify their efforts in the field of zeolite catalysis, founded a coordination council, and this book is a state-of-the-art report on the achievements of this multinational cooperation.

The book contains 17 chapters written by experts from Bulgaria, Czechoslovakia, the German Democratic Republic, Hungary, Poland and the Soviet Union. About two-thirds of these chapters focus on non-catalytic aspects of zeolite science, e.g., quantum chemical studies, hydrothermal synthesis, spectroscopic characterization, and chemical procedures for modifying zeolites such as ultrastabilization and dealumination at high temperatures by gaseous reactants such as $SiCl_4$, or isomorphous substitution of silicon and aluminum by transition metals. An excellent chapter by *Wichterlová* et al. deals with the introduction of trivalent cations such as $Al^{3\oplus}$, $Fe^{3\oplus}$ and $Cr^{3\oplus}$ into zeolites, and the catalytic properties of the resulting materials. The six catalytic chapters focus around the preparation or transformation of hydrocarbons, e.g., the disproportionation of alkylaromatics, the Fischer–Tropsch synthesis, the dehydration of methanol, and the oligomerization and hydrogenation of alkenes. In one chapter the concept of hard and soft acids or bases is applied to zeolites. The final chapter reviews industrial applications of zeolites in the German Democratic Republic: catalysts were developed at Leuna for hydrocracking of vacuum gas oil, isomerization of light gasoline, isomerization of C_8-aromatics, and shape-selective hydrocracking of n-alkanes in reformer gasoline.

This is a very valuable book which contains a number of outstanding chapters prepared with great care and expertise. Among these are the chapter by *Shpiro* et al. on the application of SIMS, XPS and related spectroscopic techniques to zeolites, the chapter by *Wichterlová* et al. mentioned above, and the review by *Becker* et al. on industrial zeolite catalysts developed in the GDR, to mention only a few. The value of the book is further enhanced by the long lists of references given at the end of each chapter and the thoroughly prepared subject index.

The contributions collected in this volume also prove that the joint endeavor of the socialist countries led to a very high level of research in zeolite materials science. Given this high level, one wonders why the book pays hardly any attention to the more recent molecular sieves, i.e., zeolites of the newer generations, crystalline aluminophosphates, and materials derived from the latter, such as silicoaluminophosphates. It is also surprising that there is no chapter on the use of zeolite catalysts for the manufacture of organic intermediates containing oxygen, nitrogen, sulfur and other heteroatoms. Nevertheless, in view of the high quality of the contributions and the well-arranged layout, the book can be recommended to everybody who is involved with zeolites and zeolite-like molecular sieve materials.

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Crystals in Gels and Liesegang Rings. By *H. K. Henisch*. Cambridge University Press, Cambridge 1988. xiii, 197 pp., bound, $ 35.00.—ISBN 0-521-34503-0

Although, in general, large crystals are not obtained in gels, the use of gels opens the door to the search for crystals with new and interesting optical or electronic properties. Moreover, the techniques are incomparably cheap and may lead to crystals of high perfection. Since the physical and chemical processes in gels are very complex, and inadequate understanding often results in poor crystal growth, this comprehensive review of the techniques of crystal growth in gels will be greatly appreciated.

This instructive presentation reveals the extensive practical experience of the author and his group. The book is divided into five chapters, the first four of which have already been published by the author in the monograph "Crystal Growth in Gels" (Pennsylvania State University

Press 1970), essentially in the present form. With 475 references up to 1986, the new presentation is excellently documented and completely covers the field of crystal growth in gels.

The first chapter gives a review of the early work on the growth of crystals in gels, and introduces the basic growth procedures, in which the gel is in contact with either one reagent reservoir or two separate reagent reservoirs. The operation of the techniques is instructively explained with examples of their application to various materials. Doping possibilities and difficulties that may be encountered are discussed for the first time in this book.

The second chapter deals with the preparation and properties of various gels. Their formation, structure, handling and properties, such as density and porosity, are described in great detail for silica hydrogels. A new contribution deals with the one-dimensional diffusion of one or two counter-diffusing reagents in gels. The diffusion is investigated by numerical method as a function of position and time. According to the two basic growth systems, solutions are determined for gels of finite and semi-infinite lengths with a single diffusant, and for finite gels with two species having equal diffusion coefficients. Constant or time-dependent concentrations are prescribed at the boundaries. Unfortunately the initial distributions are not mentioned.

The influence of reagent distribution on growth rate and crystal perfection is investigated in the third chapter. Growth models of crystals and the importance of diffusive transport are discussed. In addition, sophisticated growth methods and special treatments of growth systems such as reimplantation of crystals are described. In the fourth chapter nucleation and crystal growth are treated by the usual phenomenological theory and illustrated with experimental examples.

The last chapter presents the history of Liesegang rings, numerous instructive examples of Liesegang structures, and many numerical solutions on the formation and spreading of particular precipitation structures for the two basic growth systems. For the calculations the author considers diffusive transport, and assumes two conditions for precipitation, i.e., that the local concentration of the reacting species is nearly uniform, and that the reaction product concentration exceeds a critical value. The detailed presentation of numerical results for various parameters are very helpful in understanding the complex physical and chemical processes in gels. The interesting software used by the author is available for IBM-compatible personal computers. The chapter ends with two reference lists of crystals grown in gels and of growth rate measurements.

From this book the interested crystal grower can find much useful advice on the procedures of crystal growth in gels. In addition it provides the reader with simple theoretical models which are useful in understanding the basic processes such as diffusion, nucleation and crystal growth in gels. The book is easily readable and gives a full and up-to-date coverage of the literature. It will be of great interest to scientists who are involved in crystal growth or materials syntheses.

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Polymer Science in the Next Decade, an International Symposium Honoring Hermann F. Mark on his 90th Birthday. Edited by *O. Vogl* and *E. W. Immergut*. Wiley, Chichester 1987. x, 284 pp., paperback, £ 90.00.—ISBN 0-471-63239-2

The above book contains the proceedings of the symposium "Polymer Science in the Next Decade", which was held in New York in 1985 to honor *Hermann F. Mark*. Subdivided into four sections, it consists of a series of short reviews on a wide variety of subjects relating to contemporary polymer science. At first one might be inclined towards the view that this is one of the numerous books put together after a symposium without much editing, and hence of rather limited use. However, closer inspection reveals that the present book is indeed an interesting contribution to the literature of polymer science. First of all, the man being honored is *Hermann F. Mark*, who can certainly be counted among the great scientists of this century. Born in 1895, he has contributed greatly to physical chemistry and to polymer science. He still continues a very active schedule of travelling and lecturing around the world. So it seems rather appropriate that on the occasion of his 90th birthday a symposium on opportunities and future trends in polymer science has taken place.

The list of speakers includes renowned names such as *Paul Flory* and *Linus Pauling*. The multitude of topics reflects modern polymeric science in a very lively fashion. The short articles are useful for gaining a first insight into the present status of certain fields. Noteworthy is the contribution of *M. F. Perutz* on the design and engineering of proteins. Another well-written review by *Katchalski-Katzir*, *Wilchek* and *Patchornik* deals with chemically active and biologically specific polymers. An article of particular interest by *F. R. Eirich* gives a very personal view on macromolecules and evolution. A number of other reviews are much shorter, but still quite useful to get an idea of present trends in polymer science. In addition to these purely scientific reviews, the book contains many personal recollections concerning *H. F. Mark* and the early days of polymer science. Both the scientific part and the more personal statements are useful for anyone who wants an overview of contemporary polymer science and how it came into being. Thus, the book is certainly recommended for libraries of departments of chemistry and biology.

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