expressions for the magnetic moment and the energy. The title mentions both materials and heterogeneous catalysts, but the emphasis is clearly on the latter. The book is useful as a general introduction and as a source of literature references. I see the following uses of the book: 1) as a general reference book that must be available in a research laboratory for a quick introduction to a technique and for screening of techniques; 2) the beginning PhD student can consult the book when searching for techniques to apply; 3) it is a quick guide for selection of a new technique to be introduced into the laboratory.

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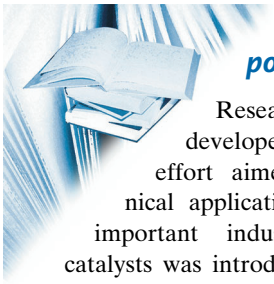


Diffusion in Nanoporous Materials

Research on zeolites has developed into an intensive effort aimed towards their technical applications, since their use as important industrial adsorbents and catalysts was introduced by Union Carbide in the 1950s. New technological developments in oxidation catalysis (e.g., in the production of propylene oxide by BASF) and in the treatment of exhaust gases are two current examples of applications that continue to drive the growth in the importance of zeolites in heterogeneous catalysis. Also, the vital role of zeolite catalysts in the production of liquid fuels (methanol-to-olefins and methanol-to-gasoline processes) is now experiencing a new upturn after some years of lower activity. The diffusion of molecules in zeolite pores is fundamental for their wide range of applications. Developments in mesoporous materials with ordered pore structures and in porous coordination polymers (metal–organic frameworks, MOFs) are two new areas for theoretical and experimental studies on diffusion applications.

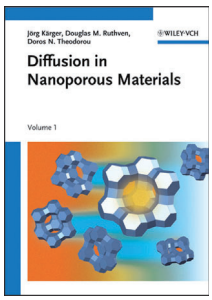
Following on from the 1992 book *Diffusion in Zeolites and Other Microporous Solids* by J. Kärger and D. M. Ruthven, which has become a classic, the title of their new work *Diffusion in Nanoporous Materials* reflects the fact that it is directed to a much broader subject area, which also includes new developments such as mesoporous materials and MOFs. In order to ensure that the rapidly growing importance of theoretical methods and molecular modeling applied to diffusion processes is expertly covered, D. N. Theodorou, one of the leading experts in this field, was persuaded to become a co-author of this work. The authors have taken the opportunity to include modern developments in techniques for measuring diffusion, such as quasi-elastic neutron scattering, NMR and micro-imaging techniques, and single molecule detection, to name just a few.

The two volumes are quite distinct in the nature of their contents. While the first volume gives a comprehensive overview of the fundamentals of the physics of diffusion and of experimental measurement techniques, the second volume is primarily devoted to the application of these principles to different materials and the importance of diffusion in separation processes and heterogeneous catalysis.

In the first volume, starting from the basic principles and the description of motion using the random-walk model, the authors focus on the peculiarities of the theory of diffusion in a porous environment. This volume ends with several long chapters on the principles of simulation methods and the measurement of diffusion processes. The reader is given an easily understandable explanation of the importance of differences in length scales and in diffusion properties (transport diffusion, self-diffusion), as well as in sample properties (surface resistance, barriers to internal transport) when different experimental methods are employed.

The second volume deals with diffusion in some specific systems. The subject matter is arranged according to the classification of the materials (e.g., on the basis of pore diameters) and their technological purpose (e.g., separation, catalysis), and through this arrangement one also obtains an excellent literature survey, including important applications in various technological processes.

More recently, new developments in the area of porous materials have been focused on the preparation of hierarchical materials with micro- and mesopores, on the development of zeolites for use in membranes, and on efforts to synthesize nanocrystals. Although some of these subdisciplines are relatively new and there is still a comparative lack of relevant experimental diffusion data, the two volumes by Kärger et al. offer a comprehensive description of the underlying fundamental principles that apply, for example, to the different diffusion mechanisms in pores of different size, or to the influence of particle size on the results obtained by different experimental methods. The authors explain very clearly the structural and dynamic factors that lead to the discrepancies often found between the results obtained with different experimental techniques for measuring diffusion, such as PFG–NMR (pulsed field gradient NMR



Diffusion in Nanoporous Materials
By Jörg Kärger, Douglas M. Ruthven and Doros N. Theodorou. Wiley-VCH, Weinheim, 2011. 2 Volume set, 872 pp., hardcover, € 349.00.—ISBN 978-3527310241

measurements), sorption kinetics measurements, or neutron scattering.

In these volumes the interested reader will find valuable information about the fundamental physics of diffusion, and a well-structured overview of various applications of diffusion experiments. The theoretical part is organized in a logical manner, and some aspects are treated in enough detail to give the reader a full understanding without recourse to the secondary literature. Some parts even resemble the style of a textbook. However, in some chapters the reader is referred to further literature to gain a full understanding of the topic. In some chapters, the reader who is interested in basic fundamentals is referred to further literature essential to easily follow the subject. Given the extensive range of subjects behind, the authors understandably had to restrict the length of some derivations.

All in all, a highly valuable source of information has been created with these volumes. The contents cover the scientific background of diffusion, including the physics and experimental methodologies as well as a vast number of applications of porous materials. The work will find its place in research laboratories and for the teaching of advanced students. The two volumes may be used to study a selected subject, or they may serve as a rich source of information that is accessible by searching the table of contents and the index.

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DOI: 10.1002/anie.201208161