BOOK REVIEWS

Pore Size Engineering in Zeolites

By E. F. Vansant, John Wiley & Sons, Chichester, 1990, 148 pp., $59.95

The main goal of this book is to review the modification techniques that can be applied to vary the porosity and pore size of zeolites. Although the text contains some information that has not resulted directly from Professor Vansant's laboratory, the book more accurately can be described as a review of the Vansant work. The topic and coverage are very narrow and are therefore most likely useful for mainly those working directly within the area.

The book contains three chapters. Chapter 1 briefly introduces zeolites. (It contains only four pages.) Chapter 2 deals with pore size engineering of zeolites. Three topics are addressed: (i) modification by cation exchange, (ii) modification by a pre-adsorption of polar molecules, and (iii) modification of the zeolite framework. Topics (i) and (ii) are covered in a superficial way and most of the chapter is involved with topic (iii). Zeolite reactions with silane, disilane, and B_2H_6 to modify pore size and porosity by depositing silicon or boron oxides are discussed in detail. This portion is the main thesis of the text. Finally, the chapter ends by describing the impregnation of zeolites with inorganic acids and salts, for example, H_3BO_3, NaH_2PO_2, and $Na_4P_2O_7$. Chapter 3 deals with the possible applications, in which modified zeolites may find use. They are: (i) the encapsulation of gases and (ii) the separation of gases. Item (ii) is a well-known use of zeolites, and modification of the pore size and/or porosity is for the fine tuning of sorbent specificities. Topic (i) is interesting and is illustrated by attempts to encapsulate Kr and Xe; ^{85}Kr is radioactive and may be stored safely if immobilized in solid form.

Since there are many zeolite structures that are known, one may wonder about the motivation for modifying a given zeolite as opposed to using a different zeolite structure. First, only a very limited number of zeolites are available in large quantities. (Fortunately, this text concentrates on mordenite which is available at commercial scale.) Thus, fine tuning of the pore architecture imparts a broader range of sorption capabilities onto a given zeolite. Second, the application of encapsulation is a fine example of how zeolite modification may find a utility that is not possible in a practical sense without modification procedures.

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Robust Process Control

By Manfred Morari and Evanghelos Zafiriou, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1989, 488 pp., $55.00

This book exemplifies the process by which basic research results find their way into engineering practice and education. It takes a deft hand to bridge that gap while retaining the texture and rigor of an active research field. In this case, the effort succeeds because the authors focus on an important technological problem, the development of process control systems that account for model uncertainty, with a coherent presentation of applicable theory. In my view, the book is a landmark in process control that may eventually alter the way control systems are conceived and analyzed.

The role of this book perhaps can be understood best in the context of the recent history of process control. Control research by chemical engineers was a dying field in the early to mid 70's. The sophisticated linear theory of that era simply was not having an impact on control practice. This point was made in several contemporaneous critiques written by industrial and academic workers (which, incidently, may also have scared away the funding agencies and a generation of graduate students). In retrospect, one can now say that the problem then was not the lack of sophistication by either academics or industrial practioners. Rather, the limiting factors for control performance were not fully understood. As a result of subsequent research, we now understand better the roles of model uncertainty, control constraints and adverse dynamical characteristics.

Uncertain models, of course, are not the exclusive domain of chemical engineers. Robust control theory was developed during the 1980's as an interdisciplinary field focusing on the explicit and quantitative treatment of model uncertainty. This line of research exploited several remarkable advances, including the parameterization of stable control systems (known as internal model control in the chemical engineering community), singular value and structured singular value analysis, and the notion of specifying performance with respect to a class of inputs signals. The last point is quite significant: it marks the difference between the older style methods of evaluating performance by case study and the newer systematic methods like H_∞.

This new understanding has dramatically changed how researchers conceptualize the design of the basic feedback control loop. This book attempts to consolidate this view for a broader community that includes a sophisticated industrial audience, graduate students,