

of complex two-phase mixtures, as are found on trays, is refreshing and encouraging. The author has an extensive background in the research, testing and modeling of distillation devices, and his authoritative text reads very well. There is no equal to the book presently on the market. Anyone concerned with the design or analysis of distillation, absorption or stripping columns of the tray type will want to take advantage of the modern approaches presented in this book. □

GAS SEPARATION BY ADSORPTION PROCESSES

by *Ralph T. Yang*

Butterworth Publishers,
80 Montvale Avenue, Stoneham, MA 02180;
352 pages, \$52.95 (1986)

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The importance of adsorption as a separation process in the chemical and petroleum industries has increased dramatically in recent years, but the subject is still not covered in any significant way in most chemical engineering curricula. There have been three recent books on the subject: *Principles of Adsorption and Adsorption Processes*, by this reviewer, published by Wiley in 1984; *Large Scale Adsorption and Chromatography*, by P. C. Wankat, published by CRC Press in 1986; and the present volume by Ralph Yang, published by Butterworth Publishers in 1987. None of these is really a textbook in the formal sense, but any of them could be used as the basis for a graduate level (or possibly a final year elective) course on the subject.

The coverage of the present volume is broadly similar to that of *Principles of Adsorption and Adsorption Processes*, and there is considerable overlap, which is probably inevitable since many of the source references are common. The emphasis is, however, different—reflecting the different areas of interest and expertise of the authors. The book provides a coherent and comprehensive account of the subject, including the basic physico-chemical principles as well as process technology. Although the title is *Gas Separation by Adsorption Processes* (and this is indeed the main focus), liquid phase separation processes such as the "Sorbex Process" and parametric pumping are also covered briefly. As with its predecessors, the emphasis is on fundamentals rather than on technological details, and the level of background knowledge which is assumed is also similar.

The book is divided into eight chapters: 1. Intro-

duction; 2. Adsorbents and Adsorption Isotherms; 3. Equilibrium Adsorption of Gas Mixtures; 4. Rate Processes in Adsorbents; 5. Adsorber Dynamics—Bed Profiles and Breakthrough Curves; 6. Cyclic Gas Separation Processes; 7. Pressure Swing Adsorption—Principles and Processes; 8. Pressure Swing Adsorption—Models and Experiments.

It is not a book for the undergraduate, but it should be easily understood by graduate students and those with some experience in research and development. Since most adsorption processes operate under transient conditions, some familiarity with partial differential equations is needed to follow the sections dealing with column dynamics and process modeling (Chapters 5 and 8). I found Chapter 3, which contains a good review of the various approaches to the correlation and prediction of multicomponent adsorption equilibria, and Chapters 7 and 8, which provide an authoritative summary of PSA technology and modeling, to be most useful.

There is no discussion of membrane separation processes which compete directly with pressure swing adsorption in a number of applications. While membrane separations may not be included within the narrower definition of adsorption processes, some such discussion would have been useful to allow the reader to assess the relative merits of either approach, particularly in view of the publisher's claim that this is a "complete treatise covering all aspects of adsorption processes . . ."

Inevitably in a book which covers such a wide range of subjects, one can expect controversy over the treatment of certain topics. For example, in the discussion of surface diffusion and intracrystalline diffusion in zeolites (pp. 113-121) it should probably have been pointed out that the kinetic treatment (which is emphasized) and the quasi-thermodynamic treatment (which is criticized) are not necessarily in conflict, but merely represent different ways of looking at the same phenomenon. The advantage of the quasi-thermodynamic treatment is that it allows meaningful transport co-efficients to be derived without knowledge of the detailed diffusion mechanism. This may not be obvious to the casual reader. Such criticisms are, however, minor, and any lack of balance is more than offset by the advantages in the presentation of coherent perspective.

Taken as a whole, the book presents a concise and readable summary of the voluminous literature of the subject. It will no doubt become required reading for those working in this area, both in universities and in industry. At US \$52.95 it is (just about) within the affordable price range for individuals. □