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### A review of: “Adsorption Processes for Gas Separation”

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BOOK REVIEW

ADSORPTION PROCESSES FOR GAS SEPARATION

F. Meunier and M. D. LeVan, Eds.

Technique et Documentation-Lavoisier, 14, rue de Provigny 94236 Cachan cedex, France. (Recents Progres en Genie des Procedes, No. 17, Vol 5, 1991), paper back, 260 pages.

Proceedings of the CNRS-NSF Workshop, Gif sur Yvette, France, Sept. 9-12, 1991.

A proceedings is just the hollow shell of the meeting particularly when the meeting is as dynamic and vibrant as the Workshop on Adsorption Processes for Gas Separation held at Gif sur Yvette. A large part of the value and joy of a meeting are the discussions during breaks and in the evening. This is particularly true when those discussions are held in Parisian restaurants. However, since the whole was so solid, the shell given by these proceedings are certainly well worth reading.

As is usual in proceedings the quality of the papers is somewhat mixed. In addition, some of the papers were clones of papers which had been presented elsewhere. On the whole the quality of the papers is quite high and there is a large fraction of results unavailable elsewhere. The proceedings are organized with a plenary lecture and then sections on Materials - Adsorption Equilibrium, Transport Properties at the Pellet Scale, Column Dynamics, and Processes and Industrial Applications. One nice addition to the four sections are reports on the four panel discussions. The recorders, who are not named, did a good job of summarizing the comments of the participants.

The plenary lecture as published in the proceedings is less than half of the talk given by Dr. Shivaji Sircar at the conference. This is a disappointment since the unpublished part included many important observations about developing PSA processes and modeling. The printed portion of the plenary lecture focuses on the development of two Air Products PSA processes which have not been extensively explored in the literature.

The other papers in the proceedings present research results. Some of these which particularly caught this reviewer's attention will be mentioned. J. T. Mullhaupt discussed the adsorption properties of a new  $\text{Ce}[\text{Fe}(\text{CN})_6]$  adsorbent which is selective for oxygen. This paper serves as a window on some of the exciting materials research being done. J. Pau presented equilibrium data for binary

and ternary systems and tested the Ideal Adsorbed Solution, Real Adsorbed Solution, and Spreading Pressure Dependence models. For nonideal systems the Real Adsorbed Solution model was the best predictor. A. L. Myers presented results on Monte Carlo simulations which help to explain why zeolites behave as heterogeneous adsorbents for polar molecules.

The session on transport properties at the pellet scale started with a paper by J. Karger on NMR measurements of self-diffusion. The following papers by H. Jobic on neutron scattering and by F. Vigne-Maeder on molecular dynamic simulations tied in with Karger's paper. This set of papers can be contrasted to the papers measuring diffusion by macroscopic approaches (Gelin and Ruthven). This comparison shows that there is a big discrepancy between these molecular measurements and diffusion coefficients determined from Fickian diffusion. Much of the panel discussion focused on resolving this discrepancy. A. Rodrigues discussed including convection in the pores which is critical when very large pore adsorbents are used. This paper ties in with much of the recent work in liquid chromatography on using very large pore sorbents.

There were a variety of interesting papers in the section on column dynamics. D. K. Friday provoked considerable discussion with his results on the importance of dispersion in packed beds. A. Rodrigues and F. Meunier each presented papers on different aspects of the pressurization of adsorbent beds - a topic which is receiving increasing attention. D. Ruthven discussed the simulation of kinetically controlled PSA cycles and explained the self-purging process when the gas slowly diffuses from the pellets. In this reviewer's opinion the most interesting paper in the proceedings is the paper by I. Park and K. S. Knaebel on the stress associated with sorbent swelling and shrinkage. They put strain gages on the column and observed waves of hoop strain and subsequent increases in pressure drop. This work may explain phenomena not only in gas adsorption but also in liquid chromatography. M. D. LeVan discussed the direct determination of periodic behavior for cyclic processes which can save a large amount of computing time.

The short final session consists of five papers on processes and industrial applications. There are two papers on simulated moving bed systems (G. Storti and G. Hotier), a paper on separation of carbon dioxide and sulfur dioxide with activated carbon (P. Gray), a paper on simulating a PSA process for hydrogen purification (E. Garcin), and a practical paper on the removal of chlorinated hydrocarbons by adsorption (L. Utiger).

The proceedings is nicely reproduced. A complete table of contents is included, but there is no index. Even a sketchy index would be useful to the reader. One nice touch is inclusion of a list of participants with addresses.

In summary, practitioners and researchers in gas adsorption will want to be sure that they or their libraries obtain a copy of this proceedings.

Phillip C. Wankat