BOOKS

Steam and Air Tables in SI Units, edited by T. F. Irvine, Jr., and J. P. Hartnett, ix + 127 pages and chart, paperback, Hemisphere Publishing Company (1976) $5.85.

With the inevitability of the metric system now apparent, this work of Irvine and Hartnett will be a useful set of tables to many, including students, academicians who have to teach those students, and certainly a not small portion of the industrial sector. The tables cover steam (both thermodynamic and transport properties), air, ammonia, Freon 11, moist air, and mercury, the last four under conditions only of saturation. The serious worker who needs steam tables will probably prefer the more comprehensive presentation of Keenan et al., with its wealth of equations. Otherwise, this present set of tables should prove a time-saver to many, as it eliminates bothersome interpolations and conversions.

The compilation seems especially appropriate as an accompaniment to a course in classical thermodynamics, where there is presently a lack of texts that make a full commitment to SI units.

A feature of these tables worth noting is the inclusion of a set of conversion tables. The unit *bar* is used for pressure rather than the more awkward *kilopascal* that appears in some international publications. A very fine removable Mollier chart for steam is included. On the other hand, there is no information on compressed (subcooled) water. In the air tables the listing s, where

$$s = \int_o^T \frac{C_p}{T}\, dT = s(T) \text{ only}$$

is labeled *entropy*, which could confuse the uninitiated student.

KRAEMER D. LUKS
Department of Chemical Engineering
University of Notre Dame

Solar Heating and Cooling, Jan F. Kreider and Frank Kreith, Hemisphere Publishing Corporation and McGraw-Hill Book Company (1976), 338 pages, $22.50.

This newest in a series of books on the application of solar energy to building climate control is written in text book style. After a brief introduction dealing with the reasons for the resurgence of interest in solar heating technology, the authors dive into a fast review of the fundamentals of heat transfer, covering such items as the computation of heat losses from buildings and seasonal variations in the solar flux at the earth's surface. A separate chapter is devoted to design concepts and methods of assessing the performance characteristics of solar collectors, with considerable emphasis being given to concentrating designs. In a chapter on solar space heating and water heating, design "optimization" rules are given for the sizes and types of solar collectors and the volume of thermal storage. The authors introduce the important concept of an economic analysis based on life-cycle costing as a method of determining the most cost-effective design. The final chapter deals with the technology of solar cooling devices, including the absorption chiller, the "solar assisted" heat pump, the Rankine power system, and several nonmechanical cooling systems. In the spirit of giving the text the flavor of a handbook, the last 45 percent of the book contains appendices, including such topics as the NBS solar collector test procedure, calculation methods for determining surface radiation properties, and a checklist of energy conservation procedures, in addition to providing numerous tables of weather data, material property data, and interest data.

The stated objective of the book is to "provide the architect, engineer, and builder with the tools required to design and construct properly engineered heating and cooling systems." To achieve this objective, the authors have provided rules of thumb and discussions of the merits and demerits of various system design approaches. It is the reviewer's opinion that the authors fail to achieve their objective. Many of the costing data used in the book appear unrealistically low, leading to sizing conclusions which are questionable. Not enough discussion is provided on the relationship between the system function (for example, hot water) and the type of collector that would be appropriate. Nor is much attention given to the various design approaches possible for dealing with such practical problems as freeze protection, corrosion, and contamination of service hot water.

On the whole, the book reads well and would serve as a useful introduction to the subject of design for the solar heating and cooling of buildings.

R. L. MERRIAM
Arthur D. Little, Inc.

Filtration Post-Treatment Processes, Richard J. Wakeman, American Elsevier Publishing Company, New York, 1975, $18.75.

This book is concerned with a very specialized subject. Filtration post-treatment processes are defined as those operations which are applied upon completion of the filtration cycle for the recovery of valuable filtrates or the reduction of the moisture contents of filter cakes. The topics included are dewatering and washing of filter cake, reslurry washing, and backwashing for deep-bed filtration. The last two topics however are treated rather briefly.

For the discussion of dewatering and washing of filter cake, the author begins with a simple but adequate introduction of two-phase flow in porous media. The phenomenon of dewatering is discussed with the use of the film drainage model, and comparisons between theory and experimental data are presented. This is perhaps the best part of the book insofar as the organization and presentation of the materials are concerned. Another interesting feature of this book is the chapter on cake cracking. Criteria of cake surface cracking in terms of cake saturation and material characteristics of cake are developed. Dr. Wakeman is to be congratulated on this account, because, traditionally, chemical engineers often overlook the importance of the mechanical properties of the filter cake in the study of cake filtration. The chapters on washing are somewhat uneven. The emphasis is almost exclusively on the role of diffusion in cake washing. The other method, filtrate displacement by washing liquid, is barely mentioned. It is suprising that the author failed to include more materials on this topic since filtrate dis-

placement is important to cake washing, and, furthermore, fluid displacement is porous media is a well studied subject.

If one reads the book with the expectation of learning how to design filtration posttreatment processes, he probably will be disappointed. The book does give good descriptions of the phenomena and problems associated with cake dewatering and washing, and it should be a valuable addition to the libraries of those who are interested in fluid-particle separation, since this is the only book on this subject currently available.

CHI TIEN
Department of Chemical Engineering
and Materials Science
Syracuse University

Mass Transfer, Thomas K. Sherwood, Robert L. Pigford, and Charles R. Wilke, McGraw-Hill Book Company (1975). 677 pages. $21.50.

It has been known by many that the third version of the book titled "Absorption and Extraction" was in preparation and that it has been a long time a-coming. The reason for the latter fact is clear after a few minutes' perusal of the text. Its pages contain a massive and thoroughly analyzed treatment of a central heartland of chemical engineering. Its 1043 references, 229 figures—many of which are correlations and summaries of voluminous data—and generous selection of numerical examples and original problems provide a rich resource for chemical engineers: a textbook for the student, a source of class material for the professor, and a lead-in to the handbooks and literature for the practicing engineer. The profession will be grateful to the three authors for their labor in making the book available.

Eight of the eleven chapters, constituting three fifths of the book, cover the scientific foundations and empirical bases of molecular and turbulent diffusion; mass transfer across physical boundaries, with or without simultaneous heat transfer; and mass transfer accompanied by chemical reaction. The last three chapters cover the design and performance of mass transfer equipment.

"Mass Transfer" belongs in a class of books that, because of the stature and diligence of the authors, serves two purposes; contents of the books show not only what is known about their subjects, but, indirectly, what is not known. What is known is in the book. What is not in the book is not known.

As to the state of knowledge about mass transfer, I have a feeling, which is supported by this book, that at present our understanding has moved well out of its first phase of over-simplified and naive models and is well into a second stage of an amorphous mix of sound science, semi-empirical observation ranging from fair to excellent, and questionable empiricism used only because there is nothing better. I hope that ahead of us there will emerge a third phase of both a simpler and more general understanding based on a more phenomenological picture of the passage of one or two phases through actual equipment, perhaps based on movement, separation, and recombination of boundary layers within the apparatus, and enhancing the power of the engineer to achieve more realistic optimizations in more extreme situations and a better understanding of the interactions of energy and transfer rates. Who knows, perhaps we may find out just what does happen in a packed tower!

WARREN L. MCCABE
North Carolina State University
at Raleigh

Polymer Engineering, H. L. Williams, Elsevier Scientific Publishing Company, Amsterdam, New York (1975) 166 pages, $14.75.

The book is a qualitative exposition of elements of polymer science and, to a limited extent, polymer engineering, notwithstanding the title of the book. The book is not a treatise on such processes as extrusion, injection molding, and calendering. It covers the following subjects: the nature of high polymers, molecular interactions, the amorphous state, the crystalline state, adhesion and autohesion, rheology, viscous flow, elastic liquids, viscoelasticity, properties and failure processes, and degradation.

A well-written book which is easy to follow, it gives a good introduction to polymer behavior and the use of polymers. For the intended purpose of the book, which is to provide a text for seniors and graduate students without any prior exposure to polymers, it is quite adequate.

The book could have been much more useful to the student if homework problems were available to show how some of the basic knowledge can be used in practice. Also, parts of the book could have been more quantitative to provide further understanding of the subjects discussed. A more serious shortcoming might be that some parts of the book, such as the treatment of abrasive wear, are inaccurate, perhaps because the book covers a wide range of topics.

N. P. SUH
Massachusetts Institute
of Technology

Principles of Microbe and Cell Cultivation, S. John Pirt, Halsted Press, Division of John Wiley and Sons, New York, 274 pages, $34.00.

This compact little book is a delightful and long-awaited addition to biochemical engineering literature. I am sure that Professor Pirt, who is a professor of microbiology at the University of London, did not write this book with only engineers in mind. In fact, this rather short document containing a surprisingly large amount of information meticulously organized is useful to all those dealing with the cultivation of microbes for whatever purposes. In addition to its fundamental significance in microbiology, cultivation of microbes is involved in a broad spectrum of technological fields including fermentation, biomass production, biological waste disposal, food processing, as well as in medical, pharmaceutical, and sanitary applications. We find in recent years an increasing number of chemical engineers engaging in these areas; to them Professor Pirt's book is valuable for easy self-study or as an excellent supplement to a biochemical engineering textbook. Unless under special circumstances, I will not recommend Professor Pirt's book by itself as a textbook for biochemical engineers. It lacks in places the necessary depth to be useful as a text for a graduate course, and it is too specialized for a general introductory course of biochemical engineering.

In dealing with advanced topics of microbe cultivation, Professor Pirt included a chapter (Chapter 20) on mixed cultures, in which he has uniquely classified and skillfully analyzed six basic conditions for maintenance of two microbial species in a chemostat culture. This chapter should prove to be a useful contribution to the literature. The treatment of growth inhibition in Chapter 17, on the other hand, seems to fall short of total satisfaction. With increasing interest in the cultivation of microbes on substances like hydrocarbons, alcohols, aldehydes, and organic acids, many of which act as inhibitors at high concentrations, an adequate treatment of the non-Monod type of growth behavior deserves much more attention. In this regard, I am also rather disappointed in the total omission of any analysis of the growth of microbes in systems involving two liquid phases (one aqueous broth and one liquid hydrocarbon substrate). Literature in this area is growing rather rapidly. Inclusion of even a brief summary of this subject would add greatly to this valuable book.

GEORGE T. TSAO
School of Chemical Engineering
Purdue University