tions. While this book is the practical manual it was intended to be, all those involved in filtration should be able to benefit from a better understanding of associated unit operations.

Although this book is not intended as a highly research oriented treatise, it would provide an excellent background for anyone starting fundamental work in filtration. It is well organized, although it is conceded that some newcomers to the field may find the organization a little awkward at first. I learned a lot from reading the book and expect it to become a frequently used reference.

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Handbook on Vapor Pressure and Heats of Vaporization of Hydrocarbons and Related Compounds, R. C. Wilhort and B. J. Zwolinski, Texas A&M Research Foundation, College Station, Texas (1971). 329 pages. $10.00.

The data sheets from API Research Project 44 are well known. However, only few individuals could own the entire compilation and keep it up to date.

A decision was reached recently to publish many of the API data in a series of small handbooks at reasonable prices. The first of these handbooks covers primarily vapor pressures and heats of vaporization for some 680 hydrocarbons and 95 related sulfur compounds.

The vapor pressure tables are direct reprints of the k and k E tables of the API 44 loose-leaf data sheets. Heats of vaporization are based on the m tables of the same reference and are derived primarily from vapor pressure data fitted to the Antoine equation and with second virial corrections for vapor nonideality.

Ready access to data of this type is invaluable to those who are concerned with hydrocarbon properties. Perhaps the only criticism that could be tendered is the continued use of English units in most of the tables even though a brief discussion on the S.I. system and some conversion factors are still presented. Nevertheless, the metric trend is manifested in the heat of vaporization tables where BTU/lb, kcal/mol, cal/g, and kJ/mol are employed.

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Biotechnology of Industrial Water Conservation, B. E. Purkiss, Mills & Boon, Ltd., London (1972). 56 pages. £ 1.50.

This book is written to provide a general background in bacteriology for the chemical engineer who has had little or no experience in this area.

The author brings his many years of experience in water treatment in this brief survey of some of the ways bacteria, and to a lesser degree fungi and algae, can disrupt industrial processes. He shows how, in just a few days, bacteria can completely plug troughs in a cooling tower, reduce heat transfer in a heat exchanger, corrode tubes and shells, and turn good water into badly polluted water. Examples are also given from the paper industry as to the destructive effects of microorganisms. A general description of the mode of bacterial reproduction and growth is presented in an easily read and understood manner.

The two chapters devoted to water recovery and use of biocides do, however, seem unnecessarily pessimistic. The only method of waste water treatment presented is the slow sand filter. Many others are in common use and I feel that additional techniques could have been described. Unlike the earlier portions of the book which dealt with specific examples from real industries, the chapter on biocides is too general and covers the whole field in only four pages. It would have been more interesting to have had more specific examples of successful or even unsuccessful control programs rather than a brief, general coverage.

I enjoyed the book and feel that Mr. Purkiss has done a good job of recording some of his experiences in a readable manner. This book should be of interest to those involved with water and responsible for its usage in a plant or process. The coverage is elementary and chemical engineers would be able to read it and learn a good deal about microbiology.

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Whiskers, C. C. Evans, M & B Monograph ME/8, Mills and Boon, Ltd., London (1972). 72 pages. £ 1.5.

This book starts with a very brief but concise and interesting historical introduction to the subject of whiskers, the hairlike single crystals of extremely small (usually in the range 1 to 100 μm^2) and near uniform cross-sections. In the three chapters which follow, the monograph answers in the same brief manner the three questions about: "Why and how a crystal grows as a whisker," "How to grow whiskers," and "What their properties (mainly mechanical) are."

If you are a person working in, or familiar with, the area, this book will not help you much. It will not answer questions which arose in your mind during your work or clarify the disturbing aspects of some of the theories. It will not even help you in terms of reference to other published works. Only a list of 17 rather standard publications in the field are supplied in an appendix as sources of further information in general.

However, if you are unfamiliar with the area and want to get an overall view of the field of whiskers, this is the book to start with. It will tell you everything you always wanted to know about whiskers (but you were very hesitant to find by searching through the details of the numerous papers reporting particular aspects of whisker crystals). You may have only one disappointment. The book may open your appetite for but be unable to help you in further reading or work. For instance, one of the tables presents examples of materials grown as whiskers by the various methods without citing any reference. Also, no reference is cited in statements like "there is some experimental evidence that whiskers do nucleate repeatedly at the same site." If you want now to grow some whiskers or to read further about the nucleating sites of whiskers, you will have to return and search through the original literature without, unfortunately, any clue from the book.

Despite the above criticisms, the book is interesting and provides an easy and worthwhile evening of reading.

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Polymer Structure, Properties & Applications, Rudolph D. Deanin, Cahners Books, Boston (1972). 496 pages. $27.50.

The stated purpose of this latest addition to the Cahners Practical Plastics Series is to "collect and organize our present understanding of the important relationships between structure, properties and applications" of polymers. The author has achieved partial success in this very ambitious undertaking.

Beginning with a very basic review of elemental properties and polymer formulae, the author proceeds to dis-

cuss how the effects of molecular size and shape, molecular flexibility, intermolecular order and bonding, macrostructure, and additives are seen in processability, physical and chemical properties, and applications. There is a final brief review of most of the commercially important polymers in which properties and applications are compared. An attempt is made to relate price to performance, but because 1967 nominal list prices are used, the results are at best qualitative.

The extensive reliance upon secondary sources for data, the most recent of which was published in 1967, results in the exclusion of almost all developments in the last 8 or 10 years. High temperature polymers are mentioned only in passing. The book is further marred by excessive repetition of definitions, tables, and graphs. As is necessary for a work of the scope attempted, only generalizations can be given without adequate detail for the design engineer or practicing processor. A few erroneous statements appear; for example, the myth is perpetrated that fluorinated polymers decompose explosively with the formation of toxic gases, and it is stated that polyvinyl alcohol is infusible.

This book will be useful at the intermediate student level (where it undoubtedly originated), to practicing engineers seeking a generalized survey of polymers and their properties, and to more serious practitioners who need a starting point for detailed projects. The compilation of data from several sources will be welcomed by theorists.

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Metal-Air Batteries and **Fuel Cells,** D. P. Gregory, Mills and Boon, Ltd., London. 1972. 79 pages and 69 pages respectively. Both about $4.00.

These two short books provide valuable supplementary material for undergraduate courses in which recent developments in battery technology are discussed. A course in introductory chemistry is adequate preparation for either one, and the many excellent photographs and diagrams give a good sense of the physical construction of these new power sources. Unfortunately neither book has student problems or exercises, although both have bibliographies which will direct an interested student to further reading.

Metal-Air Batteries is the better of the two by far. Gregory shows himself to be intimately familiar both with the history of metal-air batteries' development and with their detailed function. One of the most interesting parts of this book is its appendix, which summarizes the state of the art in a very wide variety of new battery systems and compares metal-air batteries with some of their competitors. The concepts of energy density and power density are used, and the economics of electric vehicle applications are treated in a sensible way.

Fuel Cells is less successful. First of all, the field is much larger and more highly developed, particularly in its theoretical aspects, and whatever experience Gregory has had is not sufficient for the very difficult task of summarizing a complex field in less than 70 pages. Although the hardware is well-described, the discussions of theory are very weak: concepts of efficiency and reversibility are confused and virtually no useful quantitative expressions are given. The economic aspects of fuel-cell technology have not been clearly separated from the need for special purpose applications. For example, hydrazine fuel cells are virtually dismissed because they require a relatively expensive fuel, but the implication is made that platinum-based fuel cells might indeed be economical. This is, of course, precisely the opposite of what an intelligent crystal ball gazer might predict: Platinum, being a scarce resource, will certainly become far too expensive for any but the highest-priority special purpose applications. In contrast, a concerted development effort on hydrazine production might possibly introduce substantial economies of scale. Thus, at some time in the future when gasoline is considerably more expensive than it is now, hydrazine might indeed turn out to be the cheaper fuel.

Whatever the future may bring, however, these books will certainly find considerable use in present-day undergraduate teaching.

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Instrumentation in the Chemical and Petroleum Industries, Vol. 8, Irving G. Young, (ed), Instrument Society of America, New York (1972). 109 pages. $9.00.

This book, a collection of papers concerning control instrumentation, emphasizes safety, intrinsic and otherwise, in the design, operation, and maintenance of instrumentation systems during the start-up, running, and shutdown of a process. The subject coverage essentially is a study of failures due to nonideal conditions. A general theme is that these conditions can be minimized by proper design engineering and process engineering associated with plant construction and daily on-stream operation through conventional instruments or sophisticated supervisory computers. The introduction is an excellent eye-opener or memory-jogger. It concerns plant case histories of catastrophic events and it critiques the results in each case with 20-20 hindsight.

Material in these papers contains examples of malfunctions that are not exactly common; thus the book has great value in pointing out those uncommon pitfalls that usually are not studied in textbooks. The authors bring out the importance of redundancy or diversity balanced against economic considerations, but never at the expense of personnel, process, and plant safety. They also present pertinent points gleaned from experience, as well as other information pertaining strictly to theoretical applications. In those papers dealing with design engineering, the question—"What if?" is continually reviewed to anticipate and prevent catastrophic events in future plants. Once a process is in operation, the emphasis shifts to remembering Murphy's Law—"That which can happen, will." The importance of permanent records also is emphasized as is adherence to ISA and NEC Standards with the additional consideration of OSHA.

The book should be of value as a reference book to an academician and will be of even greater value to process engineers of limited experience and to many old-timers as well. The subject matter is pertinent both to engineers and to instrumentation foremen.

A point not emphasized strongly in the papers is how well a human could and should enter the control loop without upsetting the process. An experienced operator needs to enter the loop for one of the following reasons: to make fine adjustments, to manually override, or to make changes in the set-point of a controller or a program change in a supervisory computer. This need results from his expertise in the process. No matter how much redundancy or diversity is built into the system, human wisdom should be considered. An example is the automatic light dimmer on an automobile traveling at relatively high speed around a curve having reflective guard posts. The control loop functions normally, but it dims your lights at the wrong time. Man, you'd better resort to manual override quickly or you're in trouble.

Nevertheless, considering all features