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