

Section 5 contains six papers on perceptions by society and their impact on the management of hazardous materials operations. They discuss how information about risk is communicated to the public in the U.S. and Europe and how important public perception is.

In the last section, international policy initiatives are reviewed by speakers from the United Nations Environment Program (North America), the U.S. EPA, Environment Canada (Canadian Government), Korean Government, European Economic Community, Chemical Manufacturers Association, and the World Health Organization.

The collection of papers in this book are interesting in that they emphasize the need for managers in government, industry, insurance and legal firms, public relations groups, and news media to obtain a better understanding of the complex problems encountered in the prevention and management of accidental releases of hazardous chemicals.

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Membrane Separations in Biotechnology (Bioprocess Technology Series, Volume 1)

By W. Courtney McGregor, Ed., Marcel Dekker, Inc., 408 pp., 1986, \$65.00

This volume is a quite useful and readable reference text for the practicing biomedical, biochemical or bioprocess engineer seeking guidance about the suitability of membrane processes for the separation, purification and isolation of biologically-derived products. The treatment of the subject is largely descriptive; the presentation is long on experimental data and anecdotal observations, and short on data analysis and interpretation. This book should be useful for someone who is not particularly knowledgeable in the membrane separations art, but wants to know how useful a membrane process might be for a particular bioseparation and which membranes and systems should be considered in light of their benefits and problems.

The opening chapter (authored by McGregor) is a particularly helpful compendium of the properties and operating characteristics of commercially available ultrafiltration membranes. This is followed by a somewhat circumscribed

treatment (coauthored by Sirkar and Prasad) of the polarization/fouling of ultrafiltration membranes by proteins, which, while of scientific merit, might be more appropriate as a learned journal article than as a chapter in this volume.

The succeeding 11 chapters deal with specific membrane process applications, and are replete with operating data, process flow diagrams, good descriptive text, and readable graphics. Each concludes with an extensive and reasonably current bibliography. The process that receives major attention is ultrafiltration, with applications to cell harvesting, antibiotic recovery, affinity purification, blood plasma fractionation, and food processing. There are chapters that individually address the following subjects: electrodialysis (for blood plasma processing); pervaporation/gas permeation (for fermentation alcohol recovery); reverse osmosis (for waste water treatment); and mainly dialysis (for artificial kidney). The chapter on food processing discusses both ultrafiltration and reverse osmosis applications. Two chapters deal with membrane-based bioreactors (immobilized enzyme-, immobilized plant/animal cell-, and immobilized microbial devices). The contributing authors are recognized experts and practitioners in their areas, who are well qualified to present balanced views of their subjects.

As is true of any multiauthored text covering a wide range of specific topics, however, there has been little attempt to cross-reference among chapters or to make comparative evaluations of alternative methods for accomplishing particular separations. Thus, the book is essentially a compendium of monographs, each capable of standing alone. This, however, does not detract from its value as an information source.

One feature of the editorial layout is somewhat distracting: because the figure and table captions are printed in the same font and type size as the text, it is difficult to find where the text begins on a page. Different or bold type face for captions would have avoided this problem.

All factors considered, I regard this book as a useful addition to the chemical engineering literature and recommend its acquisition by both industrial and academic engineering libraries.

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Relaxation in Glass and Composites

By G. W. Sherer, John Wiley & Sons, 1986, 331 pp.

This interesting and timely book focuses on the generation of residual stresses caused by relaxation effects in glasses that occur during manufacturing operations. The approach taken gives a reasonable balance between theoretical developments and applications. Practical assessments based on available data are woven in throughout the treatment. At critical junctures, the balance is usually struck in favor of empirical forms if the theory is found lacking, yet where appropriate the theory is amply developed. The organization of the material begins with simple, background formalisms and is built up logically to the full complexity of the topic. Overall, the book is a thorough formulation resulting in the best current single source for information on the topic.

In terms of specific assessments, however, terminology could have been clarified better, and its reference to composites in the title is misleading. The overwhelming current use of the term composites is with reference to fiber-reinforced composite materials. The treatment in the book is of no relevance to that field, rather it concerns the behavior of multimaterial structures such as sandwich forms. The last third of the book concerns application examples that represent variations of what is called the sandwich seal. This form refers to a multimaterial laminate where some layers behave perfectly elastically, but the temperature-induced relaxation in the glass layers leads to residual stresses in both materials, which can be design-limiting. The variations in this planar form simply involve extensions to cylindrical and spherical coordinates.

The key to the theoretical treatment is in the use of the concept of thermorheologically simple behavior, whereby the temperature dependence of relaxation functions can be incorporated through the well known shifting procedure. In this sense, the approach is very similar to that in polymer science. It is a happy circumstance that both fields agree on this extraordinarily unifying method of characterizing material behavior. This book demonstrates reasonable validation of the shifting procedure for oxide glasses. The treatment appropriately distinguishes between the time dependence induced by

strain changes in the material and that by temperature variations. The former is characterized by stress relaxation functions while the latter effect is referred to as structural relaxation. The pivotal development in the book concerns the means of incorporating the coupling effect between these two types of relaxation. An empirical form is invoked to introduce the effect of structure on the relaxation process by modifying the reduced time variable through a time-dependent device called the fictive temperature. The procedure is somewhat akin to introducing rate and/or history effects into the WLF form employed for the shift function in polymers. Although this procedure lacks a theoretical justification, it provides a satisfactory model of the behavior.

The book contains its share of ambiguities and possibly misleading directives. For example, the terms "pure shear" and "plane strain" are used in a descriptive

sense that violates the strict technical meaning of the terms. More importantly, the treatment of the glass transition temperature is stated in rather absolute terms that is not correct in any rigorous sense. For instance, the glass transition temperature and its empirical mimic form, the fictive temperature, are both said to be rate-dependent. As often incorrectly done, the glass transition temperature is introduced as a property and then referred to as rate-dependent as if to say a modulus is a rate-dependent property. More accurate and physically meaningful term would only allow that some observable quantity, related to the basic property, is found to be rate-dependent. In general, it can be said that the book is not easy to read, not only because of the fairly complex nature of the topic but matters of style. In descriptive passages, physical quantities are usually invoked through their symbolic form, not their meaning. The use of the book as a handy reference

may be somewhat limited, but the serious reader will be rewarded by pursuing such matters.

The overall benefits to be gained from the book far outweigh the above-mentioned limitations. The topic is soundly treated and quite comprehensive within its scope. Its most important feature is the realistic treatment of time-dependent effects acknowledging the existence of a broad distribution of relaxation times, rather than stopping short with the usual use of simple mechanical models that have tutorial advantage but come up short on physical reality. Such broad distributions are the essence of time-dependent behavior in polymers and glasses and this book conveys an admirable treatment of such effects in the latter field.

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