are described in a confusing manner.

On balance, nevertheless, both books are welcome additions to the libraries of those engineers and managers in a wide range of activities involving LPG or LNG technology.

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Introduction to Chemical Engineering Analysis, T. W. Fraser Russell and Morton M. Denn, Wiley, New York (1972). 502 pages. $17.75.

In the past two to three decades we have seen chemical engineering education swing from the Unit Operations—Technology school to the transport phenomena approach. At the extreme of this swing students have found the mathematics to be somewhat abstract and difficult to relate to reality. However, without this swing it is not easy to see how engineering could meet the demands of modern design. These authors present a good attempt to inject reality into the concepts of engineering analysis, which is the essence of engineering education.

Although the material covered is somewhat ambitious for an introductory text in chemical engineering, engineering analysis, as present in the first three chapters of Part I, is an excellent place to begin the formal education of engineers. The model development diagrams of Figures 3.5, 3.6, and 3.8 present a concise picture of the thought processes used in the analysis of physical processes. This section places proper emphasis on the mathematical model as a foundation for later sections, along with the essentials of dimensions and units. Since students often question the need for courses in chemistry, good choice is made of examples in reaction kinetics in this introductory part of the text.

The approach used in this textbook requires some maturity in mathematics, but Chapters 15, 16, and 17 of Part IV summarize the needed mathematics very effectively. The material in these chapters will require some attention as it is needed in the other parts of the text if the university does not have a strong applied mathematics department. However, the use of mathematics at this level should have a strong motivating influence on the students to master the topics covered in typical mathematics courses.

Parts II and III introduce the mass and energy balances in a refreshing way. The order of the material may require some instructors to reorient themselves, but the discussion of physical and mathematical principles as they are needed in the text has proven to be an effective approach in modern engineering education. The use of data analysis in the examples serves as an excellent introduction to graphical techniques. The instructor using this text will find a wide choice of examples of engineering analysis, all very well chosen to illustrate the unique character of chemical engineering among the engineering disciplines.

The authors of this text have formalized an approach to introductory engineering education which this reviewer has found to be most effective through fifteen years of cut-and-try. Modern engineering requires more engineering analysis than unit operations calculations of the old school, and students require an early motivation by seeing the utility of the material they study. This approach is a step in the direction which will satisfy both these needs.

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Heat Transfer in Fires: Thermophysics, Social Aspects, Economic Impact, P. L. Blackshear (ed.), Scripta; Washington, D.C. (1974). 513 pages. $28.50.

This is a collection of technical discourses by several authors which provides an excellent introduction to the state of the art of the combustion aspects of fire. With minor exceptions, the various components of fire are described in a well coordinated and cohesive fashion. The fundamental relationships which have been developed to date are reviewed and with the references cited, this book provides a comprehensive source for engineers and researchers.

The first section focuses on the social and economic implications of fire. It presents reasons to better understand the physics of fire. The annual losses from fire are cited to introduce the question of how much should be spent to reduce these losses. As one might expect, however, the reader is left with the impression that the social and economic aspects are less well understood than the growing science of characterizing unwanted fires.

The main text discusses the gross character of accidental fires, bringing in principal factors such as fuel loading, geometry, and ventilation. The chapter on fires in enclosures offers a concise summary of spreading, flashover, and fully-developed fires. This is followed by several chapters dealing with heat and mass transfer. Particular attention is paid to the condensed phase since the response of solid or liquid fuels in fires poses special analytical difficulties. Discussions of flames and condensed phase interactions, mass and energy balances, and the kinetics of pyrolysis encompass the principal phenomena. The fluid mechanics of flames are also included.

The next section of the book relates textbook radiative heat transfer theories to fires. The final two chapters provide masterful summaries of fire spread and ignition.

Although the reader can conceive of other phenomena which are important parts of the fire problem, (for example, heat transfer processes relating to human injury and the generation of toxic gases), and which might be expected to fall within the implied objectives of the book, this work does serve as a very valuable reference for technicians concerned with accidental fires.

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Selecting Engineering Materials for Chemical and Process Plant, L. S. Evans, Wiley, New York-Toronto (1974). 164 pages. $14.95.

This book purports to be of value to "chemical, design and maintenance engineers responsible for the choice of engineering materials, in all process industries" and to be "suited to all material science chemical engineering and mechanical engineering courses in universities". This reviewer feels that only those individuals who have recently emigrated from the United Kingdom could find it comfortable to use. For use in America, it can only be confusing and strange, certainly inconsistent with the technical terms and usage normal to our educational background and technological literature. For example, "E" is the symbol for yield strength, R_{20}, the room temperature ultimate tensile strength (UTS) and R_t, the UTS at design temperature. Further, the book is inconsistent in its own terminology; for example, units for stress range from N/mm.^{2} and N/cm.^{2} to KN/m^2, while pressure is given both in Kgf/cm.^{2} and N/cm^2. (A conversion table might prove of value to those not conversant with the mental gymnastics required to cope with so wide a range of units and to help anchor them to the American-English system still current in the United States.)

If the foregoing drawbacks were insufficient to recommend against this book, it also suffers from inaccuracies (for example, 600°C is cited as the temperature for the onset of creep in austenitic stainless steels, which is too high by about 150°C), typographical errors (for example, on page 13, reference 41 should be 40 and on page 33, in Table 3.2, the column headings are misprinted), and careless printing (for

example, Table 8.5 on page 70 is placed backwards on the page).

Finally, even if one were to overlook all of the above, it would still remain clear that this book may have the breadth claimed for it by author and publisher, but lacks sufficient depth to justify its price. Note that graphite is dismissed with barely a page of text, the duPont polymer Viton (so useful as a gasket material) is not mentioned, and the dispersion-strengthened alloys, TD-Nickel and SAP, are ignored. It is obvious that Mr. Evans was too ambitious in his undertaking with the result that his book is little more than a catalog of materials—certainly insufficient to be used as a sourcebook for those "responsible for the choice of engineering materials, in all process industries."

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Liquid Thermal Conductivity—A Data Survey to 1973, D. T. Jamieson, J. B. Irving, and J. S. Tudhope, Pendragon House, Palo Alto, California (1974).

This well-prepared book is an updated version of previous NEL reports that surveyed thermal conductivity data of liquids (NEL 137, 1964; NEL 435, 1969). The authors are experts in data evaluation and have tabulated and assessed liquid thermal conductivities for some 850 liquids and liquid mixtures. Organic and inorganic liquids are included as are molten salts and aqueous solutions. Molten metals are not covered. Values are graded A, B, or C to indicate the approximate accuracy, that is, <2%, <5%, and >5%, respectively.

This book will be well received and well used by process design groups throughout the world.

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Kinetics and Mechanisms of Polymerization Reactions, Applications of Physicochemical Principles, P. E. M. Allen and C. R. Patrick, one of the Ellis Horwood Series in Physical Chemistry, T. M. Sugden, editor, Halsted Press, New York (1974). Price $43.50. 586 pages.

This extraordinary work by two former students of Sir Melville Burnett, well known in their own right, deserves careful attention. In the preface the authors note

> The most important problem of polymer science now is the relationship between the mechanical and molecular properties of a polymer. Not only is the chemical structure of the polymer important in this respect, but also are the sizes and the distribution of the sizes of the constituent macromolecules. When our understanding of the relationship is better developed it should be possible to prepare polymers having prescribed mechanical properties.

The book treats comprehensively, with different organization than other works in the field, the kinetics and mechanism of polymerization reactions, with the following chapter headings: 1. Basic Physical Chemistry of Polymerization, 2. Diffusion-controlled reactions, 3. Chain Reactions in Polymerization, 4. Thermodynamics of Polymerization Processes, 5. Polyesterification and Polyamidation, 6. The Reactivity of Radicals and Ions, and the Susceptibility of Unsaturated and Cyclic Compounds to their Attack, and finally, 7. The Kinetics of Addition Polymerization. One may have minor problems with such organization, because, for example, if one is interested in anionic polymerization, one will find it treated in chapters 1, 3, 4, 6, and 7; in the long run I believe this organization will prove valuable in giving a better view of the field. Certainly the authors have succeeded in emphasizing the physical-chemical *principles* of polymerization reactions. Chapter 4 on Thermodynamics is the most complete treatment of the topic to be found in the literature. This book invites comparison with *Principles of Polymerization* by George Odian (McGraw-Hill, 1970) and with *Organic Chemistry of Synthetic High Polymers* by Robert W. Lenz, Wiley, 1967), as well as the first part of *Chimie Macromoleculaire,* G. Champetier, (ed.), Herman (Paris, 1970). The specialist in polymer synthesis will find *Kinetics and Mechanisms of Polymerization Reactions,* quite different than, and complementary to, the other works, each one of which is valuable in its own way. Considerably more attention is devoted by Patrick and Allen to kinetics and mechanisms, while some polymer producing reactions such as phenol-formaldehyde condensations and isocyanate reactions are not included.

I found the work particularly valuable for its penetrating discussion of and discrimination among references from the literature and for the authors' uniformly good presentation of their own viewpoints. They do not sift the literature as if they were novices lacking in their own opinions of plausibility and reasonableness. I also enjoyed the more than occasional appearance of wit, for example on p. 521. "While a rate coefficient for radical propagation dating from 1947 should be regarded with the same respect as a claret of that vintage, a ten-year-old coefficient for ionic polymerization should be treated with the same suspicion as a ten-year-old egg."

The book includes an up-to-date compilation of 385 references and an appendix of tables of kinetic rate constants including anionic and cationic constants for free ion, ion pair, and mixed ion-ion pair propagation not found elsewhere. These features contribute to the intrinsic excellence of the work and make it a valuable acquisition for any university library and for the collections of serious workers in the chemistry of polymerization.

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Product Design and Process Engineering, B. W. Niebel and A. B. Draper, McGraw-Hill, New York. (1974). 832 pages. $19.50.

This is a very readable and distinguished work which embraces an ambitious range of subjects pertinent to the industrial design engineer. Most notable is the discussion of material properties and manufacturing techniques for most important types of metals and polymer materials. There are also useful treatments of quality control methods, operations scheduling, and patent law. These latter issues are of particular value to the engineer in a new or small company which does not have great breadth in its technical management.

Writing with rare practical insight, the authors bring to bear fully their extensive industrial experiences and have provided both a useful text and an even more valuable reference book for the practicing engineer. This book has particular value to the graduate of an engineering science program who may be lacking in the know-how required for competence and recognition in his profession. Few chemical engineering curricula encompass any of the subjects presented in this text; this fact makes the book even more attractive to the new graduate entering industry and needing useful insights to the industrial practice of mechanical and industrial engineering.

Very few books combine the attributes of an effective academic text and the utility of a valued reference text for the practicing professional. This work, in my opinion, is one of them.

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