BOOKS

Macromolecules, Vol. 2: Synthesis and Materials, Hans-Georg Elias, Plenum Publishing Corporation, New York, 1977. 1131 + LXXIV pages. price: $39.50.

This is the second part of the two volume treatise on Macromolecules of H-G. Elias. While the first part covers Structure and Properties, this second one discusses Synthesis and Materials and, specifically, treats principles and classification of polymerization reactions, polycondensation, ionic polymerization, polyinsertion (Ziegler-Natta polymerization, enzymatic polymerization), free radical polymerization, photopolymerization, copolymerization and reactions of macromolecules. Subsequently, the Author discusses the synthesis of the most common and industrially important polymers from polyolefins to polyacrylics, polyethers, polyesthers, polyamides, polynucleotides, protein and polysacchandes.

The discussion is at the advanced undergraduate and beginning graduate level. Only elementary knowledge of organic, inorganic and physical chemistry is necessary. Mathematical derivations are kept to a minimum, while the chemical aspects of the polymerization is emphasized.

The book's strong point is the integration of the chemistry into the kinetics of polymerization reactions. Unfortunately the treatment of the structure of polymers before that of their synthesis and polymerization kinetics, as followed by the Author, does not permit a complete and more direct coupling between physical chemistry, kinetics, molecular structure and molecular aggregates in polymers (morphology). The present book, while covering these aspects less deeply than other textbooks, is more broad in scope and contains more material than many other textbooks now available on this subject. A drawback of the book when used as a classroom text is the lack of problem sets and the tendency not to articulate concepts through problems. The volume will be most useful as a self-study textbook; it contains an excellent set of references where detailed treatment of many concepts may be found.

In sum, the volume represents a valuable addition to the already long list of textbooks in macromolecular science that have appeared in recent years.

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Measurements in Heat Transfer, second edition, E. R. G. Eckert and R. J. Goldstein (editors), McGraw-Hill Book Co., New York, 1976. 656 pages. price: $29.95.

This book, which is the second edition of the well known book, *Measurement Techniques in Heat Transfer,* originally published in 1970, is a review of measurement techniques and instrumentation in experimental heat transfer. This reviewer has found the book to be both useful and understandable with respect to experimental measurement techniques.

Individual chapters are authored by acknowledged experts in their areas of research and this provides for very in-depth coverage. However, there is some repetition in descriptions of temperature scales which is no doubt attributable to this multiple authorship. There are more typographical errors in the book than one might expect in a second edition. A major change in the second edition is the replacement of the original three-part Chapter 2 on temperature measurement by two separate chapters; Chapter 2, which describes platinum resistance thermometry, and Chapter 3, which deals with thermocouple measurements. This change does not significantly alter the coverage of these topics. The new edition has added an appendix on the International Practical Temperature Scale of 1968.

Chapter 1 deals with estimation of errors in temperature measurement, particularly with regard to thermocouples. Temperature measurement using platinum resistance thermometry, thermocouples, and optical techniques is considered in Chapters 2 through 5. Chapters 6 and 7 discuss spectroscopic and other techniques for temperature measurement in high temperature gases and plasmas. Transient methods for estimating surface heat flux is the topic of Chapter 8. Experimental applications of the analogy between heat and mass transfer by convection are mentioned in Chapter 9. Chapter 10 is concerned with measurements of thermal radiation. Measurement techniques for physical properties important for heat transfer are described in Chapters 11 and 12. Chapters 13 and 14 are devoted to velocity measurements using laser-Doppler and cooled film anemometry.

The extensive reference lists at the end of each chapter are a definite as-

set. As in the past, this book will continue to be quite useful to experimentalists working in the field of heat transfer.

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Fundamental Principles of Heat Transfer, Stephen Whitaker, Pergamon Press, 1977. 556 + xviii pages. price: $50.00.

and,

Elementary Heat Transfer Analysis, Stephen Whitaker, Pergamon Press, 1977. 369 + xviii pages. price: $22.50.

The reader of any of Professor Whitaker's works is guaranteed two things: clear and logical organization of subject matter; and mathematical sophistication coupled with a lucid and economical style. "Fundamental Principles of Heat Transfer" is no exception. The selection of material is as comprehensive as length permits; and each chapter creates a firm basis for its successor. The mathematical sophistication, though present, is not forbidding; and is certainly not beyond the capabilities of junior and senior students in our modern engineering colleges.

The sequence of subject matter is, understandably, almost standard in undergraduate texts on heat transfer. This one commences with a general introduction, one and two-dimensional conduction and transient conduction. (A stronger presentation of three-dimensional calculations would help, in this section). The next three chapters cover the background material needed for a good foundation in convection phenomena; and then a relatively brief but clear and concise treatment of practical problems in convection, with an especially good treatment of turbulent cases.

Next are two chapters on the fundamentals of thermal radiation and on methods of calculation and design. These chapters are worth singling out as being exceptional in recent work. There seems to have been a tendency recently to de-emphasize or omit radiant heat exchange, in the undergraduate curriculum. These chapters are a strong incentive to reverse the trend.

The last two chapters are on boiling and condensation and on heat exchanger design. It would appear, from the preface, that the author expects these to be omitted from the material used in an undergraduate course. The view, hopefully, is unwarranted. The material is very well presented; the location in the curriculum is logical; and its inclusion should lift a burden off the unit operations courses which are typically overloaded.

As background, the student using this text should have completed thermodynamics and fluid dynamics (preferably with a strong theoretical basis in transport phenomena generally).

The problems sets are well selected (though not overly generous) and the balance between theoretical and practical design orientation is excellent. One of the strongest points, from a teaching viewpoint, is the imaginative character of many of these problems: clothing for a mountain climber, temperature changes in Lake Tahoe, and energy conservation; but also plate columns, packed columns and thoroughly practical problems on heat exchangers. Each chapter is commenced by a design problem which serves to focus the students attention on the most important points to be covered. There are many solved examples, throughout. Calculation techniques are well balanced among analytical numerical and empirical methods. The "order of magnitude" methods are likely to be of special value to students who go on into industrial design and operations.

The first chapter discusses the SI system and the present trend toward conversion. However, both the text and the problems are presented in the British system.

"Elementary Heat Transfer Analysis" is "Fundamental Principles of Heat Transfer" reduced by about one third. The pages are literally identical. As a result, most of the comments above apply. A number of topics are omitted from individual chapters, and the final chapter (on exchanger design) is omitted.

The chapter on two-dimensional conduction is omitted also, however, and this is a substantial loss. Many of the most important applications involve two and three dimensional calculations; and, in addition, the students perception of heat transfer in general is lessened.

It is difficult to see why anyone would elect to use the reduced volume except for the sharply reduced price.

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Smoke, Dust, and Haze Fundamentals of Aerosol Behavior, S. K. Friedlander, John Wiley & Sons, 1977. 317 pages. price: $16.95.

During the past decade there has been an increasing need for special courses treating of the fundamental physics and chemistry involved in the behavior of very small particles in gases. This book presents the contents of such a course developed by Professor Friedlander at the California Institute of Technology. While it may be studied successfully by anyone having a good mathematical background in physical science or engineering, it fits most congruently with the discipline of chemical engineering at the senior or beginning graduate level. The applications made are primarily to problems of air pollution control and to phenomena in the ambient atmosphere.

Following an introduction dealing with the mathematical description of aerosol particle size distribution, the book deals thoroughly with particle mechanics: the motion of particles under various force fields, and deposition by convective diffusion and by inertia. The phenomena in the atmosphere of light scattering by particles, collision and coagulation, as well as gas to particle conversion, are examined in detail, along with a synopsis of experimental methods for studying particle behavior. The book culminates in the development of the general dynamic distribution function (GDE) applied to turbulent flow and to turbulent stack plumes. Finally a foundation is laid for a rational approach to the basic problem of the relationship between ambient air quality and sources of pollutant emissions.

The coverage of principles is broad, the treatment brief and concise throughout. It assumes a considerable degree of mathematical sophistication on the part of the reader. The concepts of thermodynamics, and of transport phenomena are freely used. Some reading between the lines will be required, but an excellent list of references is provided for each chapter. The short example calculations scattered throughout, and the half-dozen or so problems at the end of each chapter are carefully designed to stimulate thought. However, for most students these would probably need to be supplemented by additional illustrations of applications and calculations.

In a sense, this may be regarded as an up-date of Fuch's classic treatise The Mechanics of Aerosols. However, it goes far beyond Fuchs in showing how the fundamentals may be applied to the current problems of air pollution control. Much of this material (especially the GDE) is the result of Professor Friedlander's own research. The book fills a basic need for fundamental knowledge required by anyone and everyone working in this field.

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