

scribe the experimental procedure, as well as factors affecting accuracy and estimation of kinetic parameters. Enough information with examples is given to make both TGA and DTA very powerful and quantitative tools. Additional analytical methods, including Gel Permeation Chromatography (GPC), Infrared Spectroscopy (IR), and Gas Chromatography (GC) are presented in less detail.

A good description of the kinetics of thermal and oxidative degradation comprises the third section. Sufficient detail and rigor are employed in order that a complete academic study could be undertaken in conjunction with the mechanisms set forth in the first section.

Factors which affect polymer stability, including the effects of various pollutants on the stability of commercial polymers, are examined in the last section. The industrial polymer chemist/engineer will find the chapter valuable in either product application work (new product areas) or environmental studies.

In conclusion, this work is an excellent single source, well-suited to industrial chemists/engineers and students or as a reference to the whole area of polymer degradation. Since each major section is essentially independent, an investigator may effectively use one without resorting to another. Both qualitative and quantitative aspects of polymer degradation are described well enough to be a useful tool.

JAMES N. MORRIS, JR.
ENJAY CHEMICAL COMPANY
BATON ROUGE PLASTICS PLANT
BATON ROUGE, LOUISIANA 70821

Thermal Radiation Heat Transfer, Robert Siegel and John R. Howell, McGraw-Hill Book Company, New York (1972). 814 pages. \$18.50.

This book originated from the notes prepared by the authors for a course in thermal radiation given to a group of practicing engineers. Its primary intention was to cover the field of thermal radiation at first-year graduate level. Because some of the topics are treated in considerable detail, however, the book can also serve as a reference for engineers working in the thermal radiation field. The text is organized in three

sections, each representing a separate area of thermal radiation. The areas are thermal properties of opaque materials, radiative interchange in enclosures, and radiation in partially transmitting media.

In the first section the authors introduce the subject of thermal properties of opaque materials by reviewing basic concepts in thermal radiation, including black body radiation and the radiation from nonblack surfaces. The basic treatment of the subject constitutes a good introduction for readers needing a review of fundamentals. One whole chapter deals with the predictions of radiative properties of surfaces from a classical electromagnetic theory. Although these predictions apply only to idealized surfaces, they can be used in practical engineering calculations to extrapolate experimental data to other ranges.

Of interest to engineers is a chapter describing the properties of real surfaces encountered in engineering practice. Although the description is limited to only a few types of surfaces, references to literature sources with more information are given. Some of the radiative properties of common engineering materials are also tabulated in accompanying appendices—a welcome addition to the book.

The second section is concerned with the radiative interchanges in enclosures, with and without other heat transfer modes present. In the opinion of this reviewer, this part of the book constitutes a valuable contribution to the literature of radiative heat transfer and is also of great interest to a chemical engineer. Starting with a brief introduction to the mechanism of radiative energy transfer in enclosures, the authors proceed to discuss radiant energy interchange between black isothermal surfaces, outlining several methods for determining geometrical configuration factors. The discussion is then extended into two areas: enclosures composed of diffuse-gray surfaces, and enclosures having some specularly reflective surfaces. In both cases methods for determining radiant energy transfer rates are described. The authors then consider radiation interchange between nondiffuse, nongray surfaces, which probably approximates most closely the true situations encountered in engineering. The difficulties in obtaining exact solutions to this type of problems are indicated.

The next chapter describes Monte Carlo methods as applied to the solutions of complex radiation problems. One of the authors has made extensive personal contributions to the development of this technique and is therefore

especially well qualified to discuss the subject.

The second section concludes with a description of radiant energy interchange in the presence of conduction and/or convection. This discussion is somewhat limited in scope, but a comprehensive list of references will permit the interested reader to find more information.

The last section treats the problem of radiation in partially transmitting media, including several areas of interest to chemical engineers. The authors discuss engineering approaches to the solution of gas radiation in enclosures including several, by now, classical methods. They also describe how to apply the Monte Carlo technique to the solution of problems in absorbing-emitting media. It is pointed out that this method is especially suitable for this application and can yield solutions to otherwise intractable problems.

One chapter covers energy transfer in emitting and absorbing media in the presence of other heat transfer mechanisms. The authors conclude that in most cases the problems become very complicated and the analytical solutions extremely difficult to obtain. In the concluding portion of this section several special topics are discussed, including the radiation from nonluminous and luminous flames. This subject may be of some interest to a chemical engineer. References at the end of the chapter provide the reader with additional sources to supplement this brief and somewhat sketchy treatment.

The material presented in the book covers a very wide scope and it is difficult to expect that all areas could be treated with the same degree of thoroughness. The reviewer finds, for example, that the text fails to mention the solutions of radiation interchange problems by means of such devices as mechanical integrator or electrical network analogue simulator. Although with the advent of digital computers these techniques became less important, they still offer a valuable tool in solving certain types of problems. The material is presented clearly and logically and can be easily followed even by a reader with limited previous knowledge of thermal radiation heat transfer. The worked-out examples in the text as well as the problems given at the end of each chapter are very useful, especially to those studying without an instructor.

K. I. PARCZEWSKI
GENERAL ELECTRIC
SCHENECTADY, NEW YORK 12301