Combustion

By I. Glassman and R. A. Yetter, Academic Press, 2008, 4th ed., 773 pp., $98.95.

Understanding the principles of combustion is not only essential for chemical engineers concerned with plant safety (e.g., avoiding explosions associated with accidental leaks or spills) and/or the transport of potentially flammable chemicals, but also chemical reaction engineers intent on maximizing the productivity and/or selectivity of, say, proposed partial oxidation reactors while avoiding dangerous local conditions (of composition and temperature).[1] Combustion is often central to the *synthesis* method of choice—as in the historically important examples of the commodity chemicals H_2SO_4, HNO_3, and TiO_2 pigment, and specialty products like optical waveguide glass.[2]

More often than not, the available combustion data (fuel-lean and fuel-rich flammability limits,. . .) must be rationally extrapolated to "unusual" or more extreme conditions—or to predict the consequences of reagent substitution. This requires insight, including an understanding of the interrelations between seemingly unrelated types of "combustion data"—e.g., steady laminar premixed gaseous flame speeds, quenching distances, minimum ignition energies, etc., Prof. Glassman's book (now available as a fourth edition, coauthored with R. A. Yetter) has not only evolved (from a brief monograph (first edition (1977); 275 pages) into a rather up-to-date and comprehensive (now 773 pages, including an expanded index) account of these principles, but also now contains relevant basic data sets (thermodynamic, chemical kinetic, flame temperatures and speeds, minimum ignition energies,. . .) suitable for many preliminary design calculations. Especially when supplemented by recent valuable treatises,[1] and (for energy transfer),[3] the practicing chemical engineer will have a useful basis for making such calculations.For those interested in using this book as a text, student exercises are provided for each of the present nine chapters. These chapters move from basic thermochemistry and chemical kinetics on to discussions of the combustion characteristics of vapors (both premixed and nonpremixed), liquids and solids, including metal powders (with the section on soot oxidation contributed by Dr. C. R. Shaddix of Sandia Combustion Research Facility). There are now no less than nine Appendices, totaling some 208 pages, including one listing currently available combustion software packages.Dr. Glassman, Emeritus Prof. (Princeton University) since 1999, was actually educated as a chemical engineer (BS and PhD) at Johns Hopkins University, but joined the Princeton University AeroE (Guggenheim Laboratories) faculty in 1950 to teach/direct research in chemical propulsion and, ultimately, the environmental consequences of combustion. This book clearly draws from his considerable experience over a remarkable 50-year period across a broad spectrum of combustion research, including combustion synthesis.Specialists/combustion researchers interested in recent theoretical advances will have to supplement many of these accounts with more unified theoretically-oriented treatments like those of Williams,[4] and Law,[5] or more focused monographs like Peters[6] (devoted to the modeling of turbulent flames), and Sirignano[7] (liquid spray combustion). However, engineers in any discipline looking for an engagingly written account of combustion fundamentals will be well-served by this fourth edition.

Daniel E Rosner
Yale University
319 Mason Laboratory
P.O. Box 208286
New Haven, CT 06520
E-mail: daniel.rosner@yale.edu

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