

Book Review

Combustion Measurements

Norman Chigier (ed.), Hemisphere, New York, 1991, 535 pp., \$125.00.

This collection of articles is one of a series of volumes that seek to provide authoritative information in the broad field of combustion science. The comprehensive title *Combustion Measurements* implies the consideration of conventional instruments, interferometric/refractive diagnostics, and spectroscopic diagnostics. Hence, it is considerably broader in scope than what has been traditionally called laser diagnostics.

The book contains 12 chapters, each authored by a recognized researcher in the measurement technology being considered. Laser anemometry, holography, light scattering, diffraction methods, spontaneous Raman scattering, and Fourier transform infrared (FTIR) spectroscopy are emphasized. Given the less than ideal conditions which prevail in many practical combustion systems, specific attention is given to applications which involve particulate-laden and two-phase combustion; there are chapters on soot and droplet/spray measurements as well as coal/char combustion measurements.

Each chapter is quite independent, and the collection is summarized by a brief introductory chapter. After a short review of the need for further combustion measurements, the Introduction describes the topics treated in the individual chapters: velocimetry, holography, temperature, particle sizing with more detailed expositions of light scattering theory and the optical properties of soot and droplets, FTIR, more conventional coal/char measurements, and the need for joint, simultaneous measurements of multiple parameters. Brief conclusions are given in the introductory chapter, rather than as a summary at the end after the techniques have been exposed and explored in greater detail.

Depending on the maturity of the technique being discussed and the availability of alternate sources of information, the author of each chapter has made an independent judgment in regard to how tutorial to be and how many illustrations of successful applications are warranted. Whereas the principles of the techniques are generally clearly elucidated, the reader will have to consult the literature on most approaches for a fuller discussion of the limits of error when it is used for combustion measurements.

One noticeable absence in the collection is the inclusion of anything but passing information on coherent, nonlinear techniques such as coherent anti-Stokes Raman spectroscopy (CARS) or degenerate four-wave mixing (DFWM). The former has a long and successful history of application to hostile combustion environments. The emergence of the latter is relatively recent and its future impact is still to be determined for turbulent or fluctuating systems. The balance of emphasis in the monograph may reflect the availability of contributions more than a unified picture of relative importance to future combustion studies.

The field of nonintrusive combustion measurements is mature enough to be recognized widely for its impact, but young enough that developments are still occurring at a fast pace. Presumably because of the length of time required to produce a volume such as this, it was not possible to include many literature citations to work done after 1990. This should not negatively impact the use of a chapter as a general tutorial on its subject. Because of the rapid advances being made in laser, detector, fiber optic, and electronics technology, other reviews will have to be consulted for the most recent work in the measurement technology or more recent successful applications to new systems. Each chapter is well supplied with figures, a helpful listing of the nomenclature used, and a set of references which will give the reader a good start into the specialist literature. The indexing appears adequate.

Combustion Measurements should be a welcome addition to the library of a technical specialist who wishes to have on hand a reference to many of the measurement technologies which are relevant to both noncombusting and combustion applications. It may be used to either supplement a general text on laser diagnostics by providing information on nonspectroscopic techniques or serve as a more detailed review of research results in the areas covered. Most readers will no doubt be selective in which chapters are undertaken, and, due to the independent nature of the chapters, a sequential approach is not necessary.

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