

## BOOK REVIEW

**Combustion: Physical & Chemical Fundamentals, Modelling & Simulation, Experiments, Pollutant Formation.** By J. WARNATZ, U. MAAS & R. W. DIBBLE. Springer, 1996. 265 pp. ISBN 3 540 60930 7, DM 88.

The main title of this book, ‘Combustion’, is a single word that must do duty for many others. Indeed even the rather lengthy subtitle, although quite useful, does not by any means exhaust the full range of topics that come within the scope of the single word combustion. For example, and especially in the present context, fluid mechanics has a great deal to do with an understanding of the processes of burning.

It was not always necessary for workers in the field of combustion studies to cover such a wide spread of topics as is the case today. It was once fair to think of combustion as a sub-topic of chemistry or chemical thermodynamics: given that one knew what was fed into a combustion system, one was primarily interested in finding out what (on the understanding that it would be in a state of equilibrium) would emerge. Of course, this implied that you were not interested in details of the processes of conversion from input to output, but such a dismissive state of affairs could not survive for long under the stimulus of both scientific curiosity and the practical necessities of technological advance.

It is a matter of common experience that a simple (low-speed) flame can maintain its position on a fixed burner against a smooth flow of combustible gases that are delivered to the burner from some suitable source. Thermal energy and active radicals, generated by chemical activity in one part of a simple laminar flame, are transmitted to neighbouring parts of the flame, *against* the flow of material into the region of intense chemical activity, by conduction and diffusion; as a result the incoming gases are pre-conditioned so that they can be consumed at a rate that maintains the flame in position on the burner. Clearly a flame of this type owes its existence to a fine balance between rates of flow, rates of diffusion and rates of chemical reaction, and the whole mini-system is a good illustration of the way in which several, superficially distinct, topics make an appearance in one elementary combustion phenomenon. It is not surprising, then, that textbooks on the general topic of combustion (and we are fortunate that there are several excellent works available today) all tend to be large.

The present book has grown out of a series of lectures given at Stuttgart University to first-year graduate students, which both makes its objectives clear and means that the authors can assume that their readers have a good level of scientific maturity, in particular that they are already used to augmenting their knowledge by making good use of lists of references. At 244 pages of text (excluding references and an index), the actual book under review is notably compact and, it should be said, concise. Evidently, at this length, there must be some facets of combustion that are either not treated at all or at best only very briefly (e.g. the burning of solid propellants in the first case, and detonations in the second).

The text deals mostly with low-speed flames, in both laminar and turbulent fields. It describes how information about such flames can be gathered, experimentally and theoretically, and makes a point of remarking on the prominent role that theoretical methods are already playing in modern combustion science. There is some focus on the details of the chemical structure of flames, as one would expect when a prime objective is to indicate how, and how much, pollutant material is created in typical combustion

processes. Altogether this is an authoritative and up-to-date text that is, within its chosen boundaries, an attractive and useful addition to the literature on combustion.

Since the book is directed at an audience that is proposing to do research in combustion it is evidently essential for it to be up-to-date. The authors invite readers to browse at their internet address for ‘...additional comments that may be part of the next edition...’ and, rather delightfully, ‘...encourage readers to send constructive critical comments...’ which, presumably, may also be part of the next edition.

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