

REVIEWS

Fundamental Data Obtained from Shock-Tube Experiments. Edited by A. FERRI. Pergamon Press, 1961. 415 pp. 84s. or \$12.00.

In addition to enabling problems of steady and non-steady gas-dynamics to be studied, the shock tube has found applications to research in an extremely wide range of physical and chemical investigations. This is mainly because it enables a gas, or gas mixture, to be heated to a high temperature with a relatively small contamination level, and at a rate which permits non-equilibrium phenomena to be studied. The present volume has been prepared under the aegis of the Advisory Group for Aeronautical Research and Development of NATO, and sets out to summarize the current state of knowledge concerning the use of shock tubes for such physical and chemical studies. The range of material covered is so wide that no single author could have written on it authoritatively at an advanced level, and the volume consists of separate monographs contributed by seventeen different writers. On the whole, the editor is to be congratulated on his choice of both material and authors, although it is clear that he has decided to undertake little detailed editorial work. The results are that the treatment is often uneven, and that there is frequent repetition of material; these defects are, however, not serious because the work does not aim at being a text-book, and the individual monographs will almost certainly be read separately by research workers especially interested in the particular fields described.

The first two chapters are intended to summarize the theory governing the one-dimensional wave motion in a shock-tube, which is essential background material for shock-tube users. In general, this object is satisfactorily achieved, although a fuller discussion of viscous effects seems desirable, together with a more detailed treatment of the non-equilibrium thermodynamics which appears in later chapters.

Because shock-tubes frequently operate at extreme pressures, and the observational time is so short, constructional details and problems of instrumentation are very important, and are discussed in the third chapter. Although useful material on shock-tube construction is included, the treatment of measuring techniques is quite inadequate; instead there is a lengthy account of the use of shock tunnels for aerodynamic research which, although interesting, seems irrelevant to the remainder of the volume.

The next chapter, which occupies approximately one quarter of the book, discusses the use of shock-tubes for the study of chemical reaction rates with special reference to the rates of dissociation of the halogens, the hydrogen-bromine reaction, nitric oxide studies, and more complex problems like the decomposition of aliphatic hydrocarbons, and the pyrolysis of hydrocarbons to form carbon and hydrogen. The limitations and difficulties of the methods are adequately discussed, and numerous examples are included of experimental results.

Shock-tubes have been used frequently for ionization studies in gases, and this work is discussed in the next chapter, which includes also a brief account of early work on the interaction of shock-tube plasmas with magnetic fields. There is little mention of the use of microwaves for the study of ionized gases in shock-tubes.

The next chapter describes the use of shock-tubes to measure vibrational relaxation times using data for nitrogen, oxygen, nitrous oxide, carbon dioxide, carbon monoxide and chlorine as examples. This is followed by a chapter on the determination of absolute intensities and f -numbers, which includes a discussion of the theory and examples of the results, but gives few details of the experimental methods.

There is then a useful chapter on the use of shock-tubes for the determination of the equations of state and thermodynamic properties of a variety of gases, and this is followed by an excellent account of the use of shock-tubes for the study of gaseous detonations—work for which the shock-tube was first used in about 1880.

The final chapter discusses shock-tube work on atomic line profiles and molecular emission spectra, and is the only place in the book where mention is made of electrical driver techniques.

The reviewer has noted no major omissions from the material covered, but to judge by the references, most of the chapters seem to have been written several years ago. It follows that there is virtually no description of a large number of recent investigations, and that further reading would be required to gain an up-to-date knowledge. This is, of course, almost unavoidable in a book describing such a rapidly developing subject; indeed, it is most valuable to have such a complete summary of early work as a basis for further reading. The volume can be recommended for reference purposes to those already engaged in shock-tube work, and as a useful introduction to those who enter the field in the future. It is well produced, and there is a good index.

D. W. HOLDER