BOOK REVIEWS

Thermal Data £10

Thermophysical Properties of Matter: The TPRC Data Series.

Vol. 1. Thermal Conductivity—Metallic Elements and Alloys. By Y. S. Touloukian, R. W. Powell, C. Y. Ho and P. G. Klemens. Pp xxvii+54+1469+46. (IFI/Plenum: New York and Washington, 1970.) $95.

Vol. 2. Thermal Conductivity—Nonmetallic Solids. By Y. S. Touloukian, R. W. Powell, C. Y. Ho and P. G. Klemens. Pp. xxix+40+1172+46. (IFI/Plenum: New York and Washington, 1970.) $85.

Vol. 3. Thermal Conductivity—Nonmetallic Liquids and Gases. By Y. S. Touloukian, P. E. Liley and S. C. Saxena. Pp. xxii+101+531+46. (IFI/Plenum: New York and Washington, 1970.) $55.

Vol. 4. Specific Heat—Metallic Elements and Alloys. By Y. S. Touloukian and E. H. Buyco. Pp. xxii+18+750+26. (IFI/Plenum: New York and Washington, 1970.) $65.

Vol. 5. Specific Heat—Nonmetallic Solids. By Y. S. Touloukian and E. H. Buyco. Pp. xxx+18+1650+26. (IFI/Plenum: New York and Washington, 1970.) $100.

Vol. 6. Specific Heat—Nonmetallic Liquids and Gases. By Y. S. Touloukian and Tadashi Makita. Pp. xviii+22+312+26. (IFI/Plenum: New York and Washington, 1970.) $40.

Vol. 7. Thermal Radiative Properties—Metallic Elements and Alloys. By Y. S. Touloukian and D. P. deWitt. Pp. xxix+47+1540+14. (IFI/Plenum: New York and Washington, 1970.) $100.

THIS is a large and expensive collection of numerical data. Volumes 1 to 7 weigh over 20 kg and cost around $450 (more if bought separately). A potential purchaser, or more likely one recommending purchase by an organization, will have to balance for himself the probable benefits against the cost. The following remarks are intended to assist him in this.

Professor Touloukian has directed the Thermophysical Properties Research Center at Purdue University since it was set up in 1957 to collect, evaluate and distribute numerical data on thermophysical properties of materials. The fifty sponsors of TPRC (one third are US government agencies) provide most of $700,000 per annum for this purpose. From 1960 to 1966 a TPRC Data Book was issued in loose-leaf form; in the UK this compilation was not widely known and few had easy access to it. It is the contents of the Data Book which have been rearranged and added to to form the TPRC Data Series.

The series is primarily a collection of data from a vast number of original literature references scattered through many journals. In some cases the data have been carefully assessed to produce recommended values. The cut-off date for inclusion of data is generally 1967 although some later work is included. The number of data and the temperature range covered vary greatly from one substance to another.

After a foreword and a preface common to all the volumes, each volume has its own short introduction and contents list, followed by a section on theory estimation and measurement. A few pages of text including conversion factors precede the main bulk of tables and figures.

Volume 1 on thermal conductivity of metals is stated to be "perhaps the most comprehensive" and covers sixty-nine elements, 277 alloys and eighty-nine compounds and mixtures. Recommended values are given for sixty-four elements and three alloys (one composition in each case). The conversion table on page 42a is incorrect, being for specific heat units, and unfortunately reappears in volume 2, which covers five elements (including seven varieties of graphite), 137 oxides, oxide compounds and mixtures of these, 127 other well defined chemical substances or mixtures and 125 complex natural or manufactured products. Recommended values are given for the elements (including four varieties of graphite), eight oxides and for two glasses.

Coverage in volume 3 is "not as comprehensive as [in] its two companion volumes" and includes fourteen elements, ten inorganic compounds, thirty-three organic compounds, eighty-two binary systems, twenty-three ternary systems and eight with more than three components. There are no data on liquid mixtures but for three-quarters of the pure substances values are given for both gas and liquid phases and the solid phase is included for seven elements. The values tabulated for pure substances are all recommended values and departure plots are shown in most cases. For binary mixtures the data have been smoothed graphically against composition, each temperature from each source being treated separately. The raw and smoothed data and the graphs are all presented and, in another part of the volume, Sutherland coefficients are given for sixty-six of the systems. There is no correlation of temperature dependence and little assessment of the reliability of different sources. No data are given for pressure dependence in mixtures. The four pages of text discussing the binary systems are placed between the data tables for pure substances and those for the mixtures and could easily be missed. A comparison of this section with my collection of references on thermal conductivity of binary gas mixtures indicates that it contains most of the material published before the cut-off date in 1967.

The specific heat of metals is treated in volume 4, which covers seventy elements and 140 alloys. In neither this volume nor in volume 5, which deals with five elements, 198 oxides, 298 other chemical substances or mixtures and twenty glasses and cermets, are there any recommended values.

Volume 6 gives data for twelve elements, ten inorganic compounds, thirty-three organic compounds and air, but no data on mixtures. For all but ten substances values are given for both gas and liquid phases. The values tabulated are all recommended values with departure plots. A new group of properties is the subject of volume 7, which deals with emittance, reflectance, absorbance and transmittance qualified as hemispherical, normal or angular and as integrated, spectral or solar (except for emittance which is either total or spectral). The number of these properties tabulated for any substance varies from one to twelve, for forty-four elements and seventy-five alloys. There are no recommended values but instead some of the properties for eighteen elements and twenty-four alloys are presented as "analysed data" graphs based on the more reliable or typical data and using the relationships between the properties.

This set of volumes contains an enormous amount of experimental data presented in a uniform and organized manner together with recommended values for a useful number of substances.

J. R. SUTTON