Materials

Treatise on Materials Science and Technology. Edited by H. Herman. Vol. 1. Pp. xii+346. (Academic: New York and London, 1972.) $18.50.

My dictionary defines "treatise" as: "1. A book or writing that treats of some particular subject. 2. A formal and systematic exposition in writing of the principles of a subject, generally longer and more detailed than an essay." The volume under review contains much valuable matter, but it is not a treatise. This needs saying at the outset, because the lines of demarcation in scientific writing are becoming ever more blurred. There is a continuous spectrum from true textbooks or treatises, *via* occasional monographs (including individual review essays), collections of reviews published at regular intervals such as progress volumes, review articles in research journals, conference proceedings, to regular research papers in research journals. Information retrieval, difficult at the best of times, becomes almost impossible when the categories are confused: a volume like that here discussed is in effect a collection of reviews, and from internal evidence will be followed by further volumes of the same kind; yet it is presented misleadingly as a treatise and will be tucked away in libraries along general textbooks (since it cannot be catalogued under any of its constituent specialist topics), and will rarely be found by those who need it. A periodical, of whatever character, should be frankly a periodical.

This said, I can warmly recommend most of the individual essays in this book. They are written at a high and consistent academic level: it is only the width of appeal that varies. Tiller opens with an exceptionally learned and interesting survey of the structure and physical chemistry of interfaces; he analyses the constituent terms of interfacial energy and relates this to the kinetics of processes such as nucleation and the development of crystal morphology. Argon follows an earlier initiative of Rosen and examines the fracture of composites in terms of a Weibull-type statistical distribution of defects. Tewary and Bullough include a very thorough (and difficult) analysis of the propagation of ultrasonic waves, of wavelengths close to the interfibre spacing, in fibre-composites, pointing out the structural information to be so derived; however, the approach is so fiercely theoretical that we never learn what variables are to be measured.

Hasson and Arsenault show how evidence can be obtained about the strength of interactions between interstitial and substitutional solutes in body-centred cubic metals by examining the modifications in the Snoek internal friction peak as substitutional solute content is varied. The article is novel and the technique promising; moreover their essay finishes with a particularly clear summary of the advantages and limitations of the technique. De Hoff contributes a mathematically deep analysis, in terms of quantitative metallography, of the links between changes in particle size, interfacial area, triple lines, etc., in both simple systems and complex ones, where impingement takes place. This essay is open to the criticism that no practical illustrations whatever are given, whereas (for instance) the equally deep essay by Tiller is made easier to follow by many applications. Finally, Haskell and Byrne describe their own work on chemical vapour deposition: this essay, being based on a single research programme, lacks the breadth of the others.

I should like to conclude with an appeal to some enterprising publisher to produce, soon, a catalogue and index of those review articles of all kinds in the broad field of materials science which have been published, say, in the past 7 years; treatises, progress series, monographs and learned periodicals should all be included. The profession badly needs this service. R. W. Cahn

Thermodynamics

Physical Chemistry: an Advanced Treatise. Vol. 1. *Thermodynamics*. Edited by Henry Eyring, Douglas Henderson and Wilhelm Jost. Pp. xxii +659. (Academic: New York and London, June 1971.) $29.50; £13.75.

Several volumes of this advanced treatise have already appeared and have been well received. The present volume deals with thermodynamics. It is, however, neither a "basic" volume for the whole treatise nor a unified survey of modern thermodynamics: it is a somewhat heterogeneous collection of essays and reviews which, while containing much excellent material well presented, does not integrate into a book which the reader is encouraged to read from cover to cover.

The book begins with a survey of fundamental laws, by R. Haase, which is mainly an account of classical thermodynamics. By using the concept of generalized work, the formulation is in principle applicable to systems in anisotropic strain states, and subjected to external fields. An introduction is given to "local thermodynamics" which is important in the discussion of continuous systems in which the values of the intensive variables vary with position in the system. No two discussions of the first and second laws of thermodynamics have the same emphasis, and it is always instructive to read a different presentation: a few pages deal with Carathéodory's method to which a whole chapter is devoted later. A modernized form of the Nernst Heat Theorem is developed; the third law of thermodynamics is mentioned, but it is recommended that neither this, nor the principle of the unattainability of the absolute zero, should be accorded the status of a "law".

Chapter 2 (by A. Sanfeld) consists of three parts, A devoted to "Equilibrium, Stability and Displacements", B on "Irreversible Thermodynamics", and C on the "Thermodynamics of Surfaces". All three sections call heavily on the work of the Brussels school. A is largely a précis of *Chemical Thermodynamics* by Prigogine and Defay (Longmans, 1954) and makes extensive use of the examples and reproduces many of the figures from this book. It introduces little new but, regrettably, reverts to the old Brussels non-IUPAC notation for several thermodynamic quantities. Part C is again based largely on *Surface Tension and Adsorption* by Defay, Prigogine, Bellemans and Everett (Longmans, 1966), but includes new work on the slow orientation of molecules at an interface. One section is an almost exact reprint from this book. Part B is a brief and hardly adequate introduction to irreversible thermodynamics.

Chapter 3 is a useful summary by R. Haase of the thermodynamic properties of gases, liquids and solids, including ionic melts.

Chapters 4 and 5 deal with the special problems of equilibria at high pressures (up to about 4kbar) (by E. U. Franck) and in external fields (by H. Henschke) and are recommended. In spite of the plea in chapter 1 that the name "third law of thermodynamics" should not be used, chapter 6 (by J. Wilks) bears this title. It covers very much the same ground and reproduces verbatim many passages from the book of the same name by this author (Oxford, 1961).

Chapter 7 (by Max Klein) on "Coupled Gas Equilibrium" deals almost entirely with the mathematical and computational problems associated with the location of free energy minima in multivariant systems, and provides an important link with modern applications of thermodynamics to chemical industry. Chapter 8 (by H. Krempl) on "Equilibria at Very High Temperatures" would have been more appropriately called the "Thermodynamics of Plasmas": the present exposition of a developing field is useful and timely. The following chapter 9 (by R. H. Wentorf) on "High Pressure Phenomena" is largely concerned with pressures greater than 20 kbar. It has a strong experimental bias and gives a good impression of the problems which make this such a difficult field. The final chapter (by S. M. Blinder), already mentioned, is essentially a plea that, now students of chemistry, physics and engineering have a "continually in-