

Book Review

Microweighing in Vacuum and Controlled Environments (Methods and Phenomena, Vol. 4), Edited by A. W. Czanderna and S. P. Wolsky, Elsevier Scientific Publishing Company, Amsterdam—Oxford—New York, 1980.

xiv + 404 pages, 181 figures, 37 tables, 882 refs., \$ 78.00

The only previous treatise in the field, "Ultra Micro Weight Determination in Controlled Environments" edited by S. P. Wolsky and E. J. Zdanuk, was published in 1969. Later advances can be gathered from the proceedings of international conferences on vacuum microbalance techniques, published partly as separate volumes (*Progress in Vacuum Microbalance Techniques*, Vols. 1–3, Heyden, London) and partly in the *Journal of Vacuum Science and Technology* or *Thermochimica Acta*. This justifies the goal of the editors of the new book "to provide a single effective source on the theory, design, artifacts, and varied applications of the beam microbalance", as stated in the preface. Crystal oscillator microbalances (of higher potential sensitivity, but of less use in temperature-dependent measurements) will be treated in a future volume.

The book has been written by 12 leading authorities of the field. Chapter 1, written by the editors of the volume, gives an introduction and microbalance review, containing among others a classification and comparison of various types of microbalances, calibration techniques, auxiliary equipment, disturbing effects, etc. Though thermogravimetry itself is not treated systematically in the book, a number of problems arising

during TG work with microbalances (high and low-temperature operation, temperature fluctuations, etc.) are discussed. Chapter 2 (by R. L. Schwoebel) presents a systematic discussion of microbalance selection considerations, construction, and operation. Sources of error have been surveyed by C. H. Massen and J. A. Poullis in Chapter 3.

After these early chapters devoted to instrumentation aspects, different fields of application follow. In Chapter 4 (by E. Robens) physical adsorption studies are discussed, including measuring techniques, evaluation of adsorption isotherms, determination of specific surface area, porosity, etc. Chemisorption studies are reviewed by A. W. Czanderna in the next chapter.

The possibilities of the simultaneous application of microgravimetry with the mass spectrometry of residual gases (W. Kollen and R. Vasofsky) and with infrared spectra (C. L. Angell) are demonstrated in the next part; then microgravimetric studies on catalysis follow (E. L. Fuller Jr.).

Chapter 9 is devoted to high-temperature studies (by E. A. Gulbransen and F. A. Brassart), the majority of the application examples being related to oxidation reactions. Appendices to this chapter present the theory of surface reactions and information on high-temperature furnaces and reaction systems. Unusual applications of vacuum microbalances (by Th. Gast) include among others vapour permeation and dust concentration measurements and determination of grain size distribution.

The volume as a whole seems to succeed in its primary objective: to be useful (and sometimes perhaps essential) in the hands of

microbalance users and those who intend to construct a new apparatus or modify an existing one. It presents the state-of-the-art in a detailed, but not excessively detailed way. Access to the information is facilitated by a logical construction and sequence of facts, as well as a comprehensive list of contents and index. "Microweighing in Vacuum and Controlled Environments" can certainly be recommended to scientists working in thermal analysis though the reviewer would have been pleased to see more examples from thermogravimetry in the book.

GYÖRGY POKOL

Defects and Diffusion in Solids, An Introduction. Stanislaw Mrowec, Elsevier Scientific Publishing Company, Amsterdam—Oxford—New York, and PWN Polish Scientific Publishers, Warszawa, 1980. 466 pages, 199 figures, \$ 83.00

In recent decades, the results of solid-state physics and chemistry have brought about a number of new industrial applications, and this field of science will certainly keep its central role in physics and chemistry in the future as well. Thermal analysis methods are most often applied in studies of solid-state processes, and thus the topic of the book is of great interest in our field too, taking into account that "the reactivity of solids and their principal physical and chemical properties sometimes depend more on the kind and concentration as well as the mobility of defects than on the nature of the solids themselves", as the author states in his preface.

Being a revised and enlarged version of a work published seven years ago on structural defects and the diffusion of atoms in ionic crystals, the present book (published as Volume 5 of *Materials Science Monographs*) focusses primarily on metal oxides and halides, although there are also several parts discussing metals and alloys.

Following a short introduction, Chapter 1 describes defects in crystalline structure.

Some crystal structures typical of metal halides and oxides are first shown briefly, and then thermodynamically irreversible (line and planar) and reversible (point) defects are discussed. Separate parts of this chapter are devoted to extended defects (defect complexes, clusters, and crystallographic shear plane defects) and to the electrical conductivity of ionic crystals.

Chapter 2 is a detailed discussion of diffusion in the solid state, including crystals with extended defects. Besides transport in the lattice, diffusion along grain boundaries and on the surface are dealt with.

While Chapters 1 and 2 are mainly theoretical, containing some empirical relationships and results of experimental studies, Chapter 3 is devoted entirely to practical methods for determining defect equilibria and diffusion coefficients in crystals. With regard to the scope of this Journal, it may be mentioned that thermogravimetry can be used for several purposes in this field.

Chapter 4, "Selected Values of Parameters of Self-Diffusion and Heterodiffusion in Metals, Alloys and Metal Oxides, Sulphides and Halides", is really a large appendix, helping the user with practical calculations. The parameters presented here are based on 465 publications.

After the list of references, the volume is completed by a subject index, which is not detailed enough: particular substances, for instance, are not included.

The construction of the chapters and the style of the book are clear and logical, showing that the author (who has published a number of results in the field) managed to handle the whole topic in a uniform and coherent way. The layout of the volume is faultless.

The monograph is an introduction in the sense that each topic discussed is started from the very basis of the relevant laws and phenomena. It will be a useful tool for both the scientist and the advanced student studying solids with thermal analysis methods.

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