

conductivity is followed by a clear presentation of the Kirkendall-Frenkel effect, the effect of pressure on diffusion, the chemical diffusion coefficient and empirical relations.

Diffusion in crystals containing extended defects is also discussed. Using the background developed in preceding sections, experimental results on diffusion in oxides of Cr, Ni, Cu and Fe are discussed. The second chapter ends with a short presentation of diffusion along boundaries, surface diffusion and reactive diffusion.

The third chapter is devoted to a detailed description of experimental methods for the determination of defect equilibria and diffusion coefficients in solids. Emphasis is given to the classical methods, especially thermogravimetric methods, which the author has used in several of his own contributions.

Volumetric and electrochemical methods are also extensively discussed. The third chapter ends with a discussion of tracer and kinetic methods for the determination of self-diffusion coefficients and with a discussion of thermogravimetric and solid-state cells for the determination of chemical diffusion coefficients.

The fourth chapter, *Selected values of parameters of self diffusion and heterodiffusion in metals, alloys and metal oxides, sulphides and halides*, gives the activation energy and frequency factor for diffusion with its major part dedicated to metals and oxides.

The subject matter discussed and the way it is presented indicate that this book should be of interest for those involved with material science in general and especially in the areas of corrosion, oxides, metallurgy, solid-state ionic devices and ceramics. The book is written from the experimentalist's point of view with careful discussion of classical techniques used in the study of materials. The large list of references supplement well the subjects of the book.

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**Thermal expansion of crystals. International series in the science of the solid state, Vol 12.** By R. S. KRISHNAN, R. SRINIVASAN and S. DEVANARAYANAN. Pp. 305. Oxford: Pergamon Press, 1979. Price £15.00, US \$35.00.

In 1958 the first of the above three authors published in *Progress in Crystal Physics*, Vol. 1, a summary of data on thermal, elastic and optical properties of crystals. The present volume greatly extends the presentation there made of the thermal expansion of crystals. After a short introductory chapter the methods of measuring thermal expansions are described in detail and all the current methods are included. The chapter contains a valuable statement of the analysis necessary in crystals of low symmetry. The third

chapter is a full account of the theoretical work done by many authors on the theory of thermal expansions in crystals. This is followed by a short chapter on the relation between thermal expansion and phase transitions, with special reference to ammonium compounds and to ferroelectricity. Then follow eighty pages of data on thermal expansion. This section is invaluable for anyone concerned with crystalline thermal expansion or any of the properties associated with it. The first three-quarters of this section refers to an exhaustive list for 370 substances. The temperature range involved goes up to high temperatures. The last part of the tables gives data for very low temperatures.

Finally, there are ninety-two pages of references to the original works from which the data have been taken.

The book is well produced with clear diagrams and well arranged tables. For all those who are concerned with thermal expansion in crystalline materials this work is to be highly recommended.

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**Crystalline electric field and structural effects in *f*-electron systems.** Edited by J. E. CROW, R. P. GUERTIN and T. W. MIHALISIN. Pp. xii + 638. New York and London: Plenum Press, 1980. Price US\$69.50.

This book is the proceedings of the international conference, on the same subject as the title, held at Temple University in Philadelphia, Pennsylvania, November 12-15, 1979. The 63 articles are divided into the following sections: 1. *Crystal field and structural effects*; 2. *Lattice effects I*; 3. *Lattice effects II*; 4. *Actinides*; 5. *Kondo and intermediate valence properties*; 6. *Transport and thermodynamic properties*; 7. *Singlet ground state and other properties*; 8. *Superconductivity*; 9. *Lifetime effects*.

A transcript of the question and answer session is found following each article. A subject index and separate material index are found at the end of the book.

One does not have to look too closely to discover errors. Thus, in the second article only 18 of the 36 references are listed at the end. However, it is almost impossible to avoid errors in a book of this type. The inclusion of the question and answer sessions is a valuable addition; however, the value is somewhat reduced since what is eventually published sometimes differs from what was presented at the conference. Thus, at the end of the second article the first question concerns the substance  $\text{PrB}_6$  which is not mentioned in the published text.

The last crystal field conference was held in Zürich in 1976 and the conference proceedings were published by Plenum Press under the title *Crystal Field Effects in Metals and Alloys* in 1977. Since this conference, important progress has been made, especially in the understanding of crystal field effects (or the lack of these effects) in the actinides. The proceedings of the present conference bring the reader up to date on this progress.