# Short Notices

## Landolt-Börnstein: Numerical Data and Functional Relationships in Science & Technology, New Series

Editor in Chief *K.-H. Hellwege*

### Group III: Crystal and Solid-State Physics, Vol, 7

*W. Pies and A. Weiss*

Part a, **Crystal Structure Data of Inorganic Compounds, Key Elements F, Cl, Br, I/Halides and Complex Halides**

General Editors: *K.-H. Hellwege and A. M. Hellwege*

Springer-Verlag, Berlin, 1974. 647 pp. DM 436. US $178.80

Also Part g, **List of References**

Springer-Verlag, Berlin, 1974. 463 pp. DM 220. US $90.20

Some time ago one of the first volumes (Vol. 6) to be published in the new Landolt-Börnstein Series was reviewed in this journal [8 (1973) 299]. That volume was principally concerned with crystal structures of elements and intermetallic compounds. The first of the two "parts", or sub-volumes, now under review is one of the five which will cover systematically the structure of some 18 000 inorganic compounds. (This compares with about 4300 compounds in the 1955 edition). The second sub-volume gives the journal references for all the 18 000 compounds, including those covered in parts b to e which are yet to appear. Part h will be a general index for the whole of Vol. 7.

As in Vol. 6, very full information is given about space group, lattice constants (including their dependence on composition where this can vary), methods of diffraction or spectroscopy used, crystal habit, Debye factor, twinning laws, epitaxial behaviour, melting-point, solubilities, etc., indeed, everything imaginable except the actual atomic positions and bond lengths. These have to be sought in the original papers. Editorial judgment has been exercised where multiple results are available, but often more than one set of values is quoted. The editors are at pains to point out that "newest" need not imply "best".

It is gratifying to note that among the selected journals specially consulted is the *Journal of Materials Science.*

These books are extremely costly but they set a standard not approached by any other compilation. Libraries which take themselves seriously in the materials field should strive to acquire these volumes and their successors.

R.W.C.

## Einführung in die Elektrochemie fester Stoffe

*H. Rickert*

Springer-Verlag, Berlin, 1973. 223 pp. DM46. US $18.90

This fairly concise introduction is in the distinguished tradition of German texts on solid-state chemistry, of which Hauffe's classic text of 1966 was one of the most recent. The author expresses his indebtedness to the Grand Old Man of German solid-state electrochemistry, Carl Wagner. The book outlines the basic ideas of defects in crystallic solids, the relationship between band theory and the chemical potential of electrons, mobility and diffusion, galvanic cells, and solid state reactions, including their kinetics as investigated electrochemically. Experimented methods and results are discussed but only schematically. The book is a theoretician's aid rather than an experimentalist's handbook. Superionic conduction is not discussed: the book is complementary both to larger and more comprehensive general texts such as Kröger's book and to the recent massive specialist conference report on superionic conductors. It represents good value for money for readers of German actively concerned with the electrochemistry of solids.

R.W.C.

## The Science of Hardness Testing and its Research Applications

Editor: *J. H. Westbrook and H. Conrad*

ASM, Metals Park, Ohio, 1973

This book makes a welcome addition to those published in the last three decades on the subject of hardness. It concentrates on new work designed to shed light on some of the problems that have worried workers in the field and avoids a repetition of the accepted concepts such as definitions of the various types of hardness testing and the apparatus required to carry them out. Basically, the book consists of 34 papers presented by experts from seven different countries at a three-day symposium arranged by the American Society for Metals in Detroit in 1971. The text includes nearly a thousand references and has comprehensive author and subject indexes.

One of the most controversial problems of hardness testing is the problem of whether the basic hardness of a material remains constant with variations in load. Experimental data are available which show all possible effects on the hardness with reduction in load, namely no change, a decrease and an increase, and authors have provided theoretical evidence to support all three types of result. Only one paper deals specifically with this aspect and this reports a decrease of diamond pyramid hardness with load below 5 g on a high-purity single crystal of silver, samples with a high dislocation density showing the greatest effect. Some authors hold the view that surface energy effects may be an important factor at low loads and Westwood and his co-authors shed some light on this by applying a potential to zinc monocrystals while making tests at 25 g loads. A theoretical interpretation is given of the observed data which show no hardness variation on a $(10\bar{1}0)$ prism face but a marked effect on the basal plane. This assumes that the electrical charge density at the surface affects the surface energy which in turn decreases the mobility of the dislocations at the surface and increases the hardness.

Another important topic is dealt with in six papers discussing how the anisotropic plastic behaviour can be characterized from a study of hardness indentations. Although great strides have been made in this direction, lack of a precise understanding of the metal behaviour and flow pattern under the indentor is slowing down further progress. Results are given for a wide range of materials from cubic metals to compounds such as oxides and fluorides. The fact that Knoop indentations can be made on diamond is taken as evidence that plastic flow can occur in these hard materials at room temperature. The same conclusion is drawn also in the case of ceramics which are normally considered as brittle materials but which must be able to yield on a microscale to give indentations without cracking. Tests on very hard materials used as abrasives such as boron nitride, silicon carbide and corundum show that their hardnesses relative to diamond and each other are maintained up to 1300° C.

Other aspects considered include the hardness testing of glasses and plastics, changes in hardness of semiconductors due to incident illumination resulting in a change in bonding and a so far unexplained hardening in the region of grain boundaries in metals. The impossibility of creating universal conversions from one hardness scale to another is well demonstrated in a paper by Gilman. The book concludes with a chapter by Buckle on the correlation of hardness with a number of properties, particularly the structural constitution, mechanical properties, etc.

Although the title of the book is "The Science of Hardness", taken as a whole it demonstrates very clearly that while hardness is a nebulous property still far from understood it is, nevertheless, a very useful characteristic to measure. Anyone using hardness testing either as a research tool or as an inspection technique should read this book as they are bound to find something of direct interest in their own field of application.

B.W.M.