Book Reviews

Works intended for notice in this column should be sent direct to the Book-Review Editor (J. H. Robertson, School of Chemistry, University of Leeds, Leeds LS2 9JT, England). As far as practicable books will be reviewed in a country different from that of publication.

Acta Cryst. (1985). A**41**, 110

Positron solid-state physics. Edited by W. Brandt and A. Dupasquier. Pp. xx+710. Amsterdam: North Holland, 1983. Price Dfl 335.00.

Another book on the fringe of crystallography.

Positrons ('positive electrons'), obtained conveniently from radioisotopes such as ^{22}Na, can be used as a novel tool for the investigation of matter. Their most characteristic behaviour is the well-known annihilation of matter when e^+ and e^- meet, producing two oppositely directed γ-ray photons (having energy 0.511 MeV). Despite the ubiquity of ordinary electrons in matter, irradiation of solids with simultaneous observation of the emitted γ photons can give considerable information. Annihilation rates are proportional to electron density; the γ-ray photon energies can be modified by the energy distribution of the electrons in the solid; delay (*e.g.* of 250 ps) of the annihilation event can occur owing to positron–electron correlations, or to the formation of positronium atoms, *P*s, which survive for about $\frac{1}{2}$ ns. These, and other effects, are affected by phase changes of the solid (or liquid), by temperature change and, especially, by the presence of defects in the solid, which tend to trap *P*s, for example. Hence the information relating to the solid phase investigated. However, the theory is far from simple.

This substantial volume records the proceedings of the International School of Physics that was held in July 1981, at Lake Como. It is emphatically not a text for students, but is addressed essentially to positron physicists.

J. H. Robertson

School of Chemistry
University of Leeds
Leeds LS2 9JT
England

Acta Cryst. (1985). A**41**, 110–111

Advances in X-ray analysis. Vol. 26. Proceedings of the 1982 Denver Conference on the Applications of X-ray analysis, Denver, Colorado, August 1982. Edited by G. R. Hubbard, C. S. Barrett, P. K. Predecki and D. E. Leyden. Pp. xvii+473. New York: Plenum Press, 1983. Price US $62.50.

This meeting has focused on recent developments in measurement accuracy of 2θ and intensity in powder diffraction. The articles in this volume have been collected into eight sections including six invited papers: accuracy in X-ray powder diffraction; search/match procedures, powder diffraction file; quantitative XRD analysis; XRD applications and automation; X-ray stress determination, position-sensitive detectors, fatigue and fracture characterization; new XRF instrumentation and techniques; XRF computer systems and mathematical corrections; XRF general applications.

In the first part of the book the five invited papers of the plenary session give a broad perspective of recent activity throughout the world on uses of more accurate data, on methods to achieve greater accuracy, and on fundamental factors affecting the accuracy; the developments leading to the current levels of accuracy in angle and intensity measurements in X-ray powder diffraction are surveyed and the effect of alignment of the diffractometer on the parameters, such as measured 2θ and intensity values and the calculated *d* values, is also discussed.

The second section describes several computer search/match strategies using a very restricted data base in connection with data processing systems and the optimization procedures in profile fitting. The accuracy of quantitative analysis is of great concern in many laboratories. In the third section, several examples of quantitative evaluation of the results of X-ray diffraction, paying attention to both the effects of preferred orientation and the separation of overlapping peaks, are collected; the limitations in quantitative analysis as well as the techniques being employed to improve the results obtained are mainly described. Several applications to a variety of materials and strategies for phase identification by X-ray diffraction, with sophisticated computer methods, are described in the fourth section.

The fifth section, containing 13 papers, reports the results obtained by the application of X-ray diffraction - new techniques for X-ray stress analysis including the use of position-sensitive counter and X-ray fractography for the analysis of fracture mechanisms.

The detection limits and the reproducibility of X-ray fluorescence analysis (XRF) can be increased by various kinds of background reduction and by optimizing the sample preparations and excitation conditions. The sixth section reports recent applications, such as the capability of continuum synchrotron radiation (SR) as a primary source, the reduction of electronic noise by using a cooled input FET preamplifier, a means of increasing the polarized X-ray intensity and a technique for radioisotope-excited characteristic X-rays for X-ray fluorescence.

In the seventh section, computer systems for X-ray fluorescence (XRF) analysis, including fundamental parameter technique programs in energy-dispersive X-ray fluorescence (EDXRF), are considered in connection with matrix-correction methods. Finally, the last section reports XRF general applications to various materials, such as minerals, human bone *in vivo*, glass, coating metal films and coal, together with several examples of simultaneous analysis by a multichannel X-ray fluorescence spectrometer.

This text is therefore invaluable to researchers engaged in X-ray powder diffraction and X-ray fluorescence studies because it offers a lot of interesting pioneering work so that they can stay current with the field. This book will also be of interest to scientists who wish to study new research fields in the applications of X-ray diffraction.

O. NITTONO

Department of Metallurgy
Tokyo Institute of Technology
Meguro-ku
Tokyo 152
Japan

Acta Cryst. (1985). **A41**, 111-112

Современная кристаллография. (Contemporary crystallography.) Vol. 4. Physical properties of crystals. (In Russian). By L. A. SCHUVALOV, A. A. URUSOVSKAJA, I. S. ZEŁUDJEV, A. V. ZALESSKIJ, S. A. SEMILIETOV, B. N. GRECZUSZNIKOV, I. G. CZISTIAKOV and C. A. PIKIN. Pp. 484. Moscow: Nauka, 1981. Price 4r 80k.

This fourth volume of *Contemporary crystallography*, entitled *Physical properties of crystals*, has been written by eight co-authors-high specialists from the Institute of Crystallography of the Academy of Sciences of the USSR. The book is divided into eight chapters. In my opinion, the content of this book is well chosen.

The first chapter, by L. A. Schuvalov, is devoted to the basis of tensor calculus and its application to describing physical properties of crystals. Readers who acquaint themselves with this chapter will better understand the following parts of the book devoted, in particular, to the problems of the mechanical, electrical and optical properties of crystals, and transport phenomena. Understanding the properties and phenomena characteristic of well-ordered solids enables one to appreciate better the problem of liquid crystals described in the last chapter of this book. The authors emphasize that their approach to the subject is different from that usually adopted in solid-state physics. Their own way of seeing the problems expounded in this book is from the standpoint of physical crystallography. The authors also consider the anisotropic properties of crystals and their connections with point and space symmetry and with atom and real crystal structures.

The second chapter is written by A. A. Urusovskaja. The most interesting subsection is that devoted to the characteristic strain surfaces and ellipsoid deformations of crystals, as well as the influence of crystal symmetry on the form of tensor coefficients of elasticity. The bulk compressibility of crystals is very significant. The author also discusses the problem of plastic deformation and the role of dislocations in this process. Especially interesting is the passage describing the diffusion mechanism of plastic deformation. Readers can also find general information on the processes of mechanical twinning and crumbling of crystals. Lastly, the author gives a detailed description of some methods for determining the mechanical properties of crystals, *e.g.* hardness measurements, techniques for elastic and plastic properties, studies for determining crystal capacity for cracking and for determining the long-time strength. Reading this passage I felt a little unsatisfied because in recent years there has been considerable progress in electron-microscopic studies on *in situ* structural changes in plastic deformation and cracking processes. In studies of elastic crystal properties optical methods are also of great importance. Independently of these critical remarks I rate this chapter, devoted to the mechanical crystal properties, very highly. The author gives many graphs and photographs, which serve as illustrations of the state of the field and the possibilities of the various measuring methods. The choice of literature sources is quite impartial.

The third chapter, entitled *Electrical properties of crystals*, is written by I. S. Zełudijev. The author discusses in detail phenomena closely connected with anisotropy. The electrical properties of crystals he defines as a series of phenomena connected in various ways with electrical polarization. Pyroelectric and piezoelectric effects are connected on the one hand with anisotropy and on the other with polarization. A lot of space is devoted to the new classes of materials, *e.g.* segnetoelectrics, their structures and properties, as well as to phase transitions. In the introduction to this chapter the author considers the important role of pyro- and piezoelectric phenomena from the practical application point of view, namely in optoelectronics, electro-acoustics and in energy transformation. The choice of bibliography for this chapter testifies to a good knowledge of the subject.

The fourth chapter, by A. W. Zaleskij, is devoted to the magnetic properties of crystals. Magnetic phenomena are discussed from the point of view of their symmetry features. The author discusses so-called magnetic symmetry and the application of symmetry rules for explaining physical properties of anisotropy and for describing magnetic structures. It should be noted that this author takes up in more detail the problem of the anisotropy of ferromagnetic crystals from the crystallographic point of view. He devotes many pages to the phenomena of the domain structure of ferromagnetic crystals and to the processes of magnetization. In my opinion, the problem of the structure of some magnetically ordered crystals, presented here is very interesting. The author bases this chapter on recent publications from 1973 to 1978.

The fifth chapter, by S. A. Semiletov, is devoted to semiconductor crystals. The author characterizes semiconductor properties and goes over the basic phenomena occurring in this type of solid, in the monocrystalline state. This section is concerned mainly with silicon and germanium and $A^{IV}B^{IV}$, $A^{III}B^{V}$, $A^{II}B^{VI}$ and $A^{IV}B^{VI}$ compounds. The author gives much attention to electron-hole transitions and to the mechanisms characterizing the action of diodes, transistors, lasers and semiconductor photoelements. This chapter is very compact and gives fundamental information on the applications of semiconductor devices.

The sixth chapter, by B. N. Grechushnikov, expounds transport phenomena in crystals, particularly the transport of electrical charges and heat in crystals, occurring in the processes of electrical conductivity, thermal conductivity or diffusion. The author characterizes the processes connected with thermoelectric phenomena and the simultaneous appearance of gradients of electrical potential and temperature, as well as galvanic and thermomagnetic effects. Considering this problem widely, he discusses the influence of crystallographic direction and symmetry. The problem of applying these effects to various techniques is also presented. The last subsection is devoted to the tensors of the Hall, Righi, Righi-Leduc, Nernst and Ettingshausen coefficients and to the magnetoresistance of crystals belonging to the different classes. The bibliography, dated 1958-1977, utilized in this chapter is rather short.