

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*

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**Современная кристаллография. (Contemporary crystallography.) Vol. 4. Physical properties of crystals.** (In Russian). By L. A. SCHUVALOV, A. A. URUSOVSKAJA, I. S. ZELUDJEV, A. V. ZALESSKIJ, S. A. SEMILETOV, B. N. GRECHUSZNIKOV, I. G. CZISTIYAKOV 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 import-

ance. 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. Zeludjev. 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.

The seventh chapter, by J. G. Chystiakova (one of the longest in the book) deals with the optical properties of crystals. The chapter starts with the consideration of plane electromagnetic waves in anisotropic media and then also their behaviour in mono- and biaxial crystals. Such an approach to the subject is a good introduction to the description of the phenomena of binary refraction and light interference in crystals. The other subsections of this chapter concern light absorption and optical activity. The separate problems are the electro-optical, magneto-optical and piezo-optical crystal properties. This subject is richly illustrated by tables of data of the linear electro-optical coefficients and the tensors of elasto-optical coefficients for crystals of different classes of symmetry as well as piezoelectrical and elasto-optical coefficients for some cubic crystals. Also listed are the characteristics of some acousto-optical crystals, e.g. GaP, K, P and LiNbO<sub>3</sub>. In the next subsection the author discusses the principle of light dispersion theory, non-linear optical properties and the basis of crystal field theory. She also characterizes laser crystals and the phenomenon of polarized crystal luminescence. For this chapter a rich bibliography dated 1950-1977 has been used.

The last chapter, written by S. A. Pikin, is devoted to liquid crystals. This is a novelty in a handbook on crystallography. Firstly, the author touches on the characteristics of liquid crystals and their optical properties. In the next subsection we find the principles of liquid-crystal theory and information on the magnetic, electrical and thermal properties of liquid crystals. The text of this chapter is excellently illustrated by many colour photographs of typical nematic, cholesteric and smectic structures. The bibliography covers 70 years of publications.

This book will be valuable for all students interested in physics and chemistry. It contains much interesting information for post-graduate students too, who, by that stage, will have touched on crystallography to a greater or lesser degree. I feel this book will also be very helpful to academic teachers for the preparation of lectures. Researchers engaged in the solid-state field will find much valuable information. The authors who composed this book based it mainly on the Russian/Soviet scientific literature together with Anglo-Saxon literature. Any critical remarks in this review do not in any way depreciate the merit of this book, which, in my opinion, is a most valuable publication on crystallography.

J. AULEYTNER

*Instytut Fizyki  
Polskiej Akademii Nauk  
02-668 Warszawa  
Al. Lotników 32/46  
Poland*

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### Books Received

*The following books have been received by the Editor. Brief and generally uncritical notices are given of works of marginal crystallographic interest; occasionally a book of fundamental interest is included under this heading because of difficulty in finding a suitable reviewer without great delay.*

**Modern crystallography. Vol. III. Crystal growth.** By A. A. CHERNOV, with contributions by E. I. GIVARGIZOV, K. S. BAGDASAROV, V. A. KUZNETSOV, L. N. DEMIANETS and A. N. LOBACHEV. Pp. 20+517. Berlin: Springer-Verlag, 1984. Price DM 154.00, £46.20. This book, just published, is the English language version of Vol. III of the four-volume work on modern crystallography by a large group of Russian authors, whose Editor-in-Chief is Professor Boris Vainshtein. The English volumes tend to follow their Russian language counterparts with a time lag of about two years. In this case the Russian Vol. III came out in 1982 and a review of it has already been published [Auleytner, J. (1983). *Acta Cryst.* A39, 272]. To the original review, the comment may be added that the authors have again taken advantage of the two-year delay due to translation and re-setting by modifying the text and figures here and there, adding extra references, and so on, making the English version rather more than a mere translation but almost a re-editing of the Russian text. As with the previous two volumes, this one, although more specialized (dealing in great detail with crystal growth) is certain to be well received.

**The structure of matter: from the blue sky to liquid crystals.** By A. GUINIER, translated from the French by W. J. DUFFIN. Pp. x+230. London: Edward Arnold, 1984. Price £9.95. André Guinier, internationally known for his crystallographic achievements and for his warm personality, wrote this book three years ago, in French. (A retired crystallographer, he has explained, can render this sort of service to the public.) Dr Duffin's translation now makes this excellent popular presentation of science available to the world of English-speaking readers. It is truly a most attractive production, full of intriguing and enlightening illustrations, artistic and attention-holding, and, of course, scientifically sound. The original French edition was reviewed by G. S. D. King [*Acta Cryst.* (1982), A38, 559; B38, 1685] who remarked, 'The author's style is so clear that it is a pleasure to recommend this book...'. It is to be hoped that many schools, school pupils and teachers, parents, laymen, ... and even Universities, will make use of it.

**Local density approximations in quantum chemistry and solid state physics.** Edited by J. P. DAHL and J. AVERY. Pp. xv+851. New York: Plenum, 1984. Price US \$125.00.