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.

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Crystal growth and characterization of polytype structures. Edited by P. KRISHNA. Pp. 502. Oxford, New York, Toronto, Sydney, Paris, Frankfurt: Pergamon Press, 1983. Price US $141.00.

This book appears as the seventh volume in the series *Progress in Crystal Growth and Characterization* edited by B. R. Pamplin with the aim to serve temporarily as a standard reference book. It can be considered as a supplement to and an update of the monograph by A. R. Verma & P. Krishna *Polymorphism and Polytypism in Crystals* (J. Wiley and Sons, New York, 1966), which gave a balanced account of relevant aspects of polytypism until 1965, soon became a 'Bible' of polytypists and remained unsurpassed until today.

The development in 'polytypology' did not proceed only along the lines shown in the book by Verma & Krishna, devoted almost exclusively to the growth and identification of polytypes with close-packed structures. In 1964 B. B. Zvyagin published *Electron Diffraction Analysis of Clay Mineral Structures* (Moscow: Nauka; English translation New York: Plenum Press, 1966) with the most complete geometrical analysis of polytypism of sheet silicates to date, and electron diffraction on oblique textures as an efficient tool for their investigation. In the same year, K. Dornberger-Schiff published her monograph *Grundzüge einer Theorie der OD-Strukturen aus Schichten* [*Abh. Dtsch. Akad. Wiss. Berlin Kl. Chem. No.* 3 (1964)] in which, as it turned out, she laid down the fundamentals of the symmetry of polytypic structures. And it was Brafman & Steinberger [*Phys. Rev.* (1966), **143**, 501] who explained plausibly the dependence of optical properties of ZnS on the stacking of layers in its polytypes, which stimulated interest in the physical properties of polytypes. High-resolution electron microscopy also proved itself as an indispensable method for the study of the actual stacking of building layers in polytypes. It would be too difficult to examine critically all the papers that followed and combine them into a self-contained monograph at the present time. The editor of this volume, Professor P. Krishna, should therefore be given credit for endeavouring to cover all these fields by review articles written by renowned specialists. However, Professor K. Dornberger-Schiff died before finishing her contribution, and the article by Professor B. B. Zvyagin was transferred to the next volume in this series. As a result, this book is not so well balanced as it was intended to be and deals in its eleven contributions with close-packed structures only. Their titles, authors and brief characteristics are as follows.

Polytypism in zinc sulphide (I. T. Steinberger). Preparation of ZnS polytypes, description of their morphology, structure, identification and formation processes. Attention is paid also to their structure-dependent optical properties, phonon dispersion and anomalous photovoltaic effect. Well written but insufficient coverage of the more recent literature.

Polytypism in the III–VI layer compounds (J. C. J. M. Terhell). Description of polytypes of GaS, GaSe, InSe and GaS_xSe_{1-x}, their preparation, considerations of the dependence of crystal habit and structure on the preparation technique as well as of growth mechanisms.

Progress in controlling the growth of polytypic crystals (Yu. M. Tairov & V. F. Tsvetkov). A highlight of this book. A systematic and qualitatively new route towards the controlled synthesis of SiC polytypes. The authors were able to combine different theoretical and experimental methods and obtained desired polytypes – a unique achievement at present. The contribution shows that the building layers in polytypes are not rigid units and indicates how important detailed structural studies of individual periodic polytypes are. Figure 24 showing photoluminscence of the hetero-polytypic composition $6H$–$4H$ SiC deserved a colour print.

Structure determination of polytypes (M. Farkas-Jahnke). Brief but incomplete survey of polytype notations. The trial-and-error method deserved more attention and a wider coverage of recent literature. The main part of this article deals with an original direct method using a 'Pattersonian' function. It is commendable that this method is described in detail and illustrated by examples.

The origin of polytype structures (D. Pandey & P. Krishna). Another highlight of this book, giving a theory based on the role of screw dislocations using the perfect-matrix as well as the faulted-matrix model. This enabled the authors to explain plausibly the growth of long-period polytypes also. A well written article containing details and examples.

Polytypic transformations in silicon carbide (N. W. Jepps & T. F. Page). A special paper showing results of studies, using mainly high-resolution electron microscopy and electron diffraction. Table 2, containing a comparison of various microstructural techniques for identification of polytypes, is very instructive.

$Ti_{1+x}S_2$ *polytypes* (J. J. Legendre, R. Moret, E. Tronc & M. Huber). Another special paper, which deals mainly with the polytypes of $Ti_{1.18}S_2$, their synthesis and formation mechanisms. It contains a useful recommendation to use the convergence method for the identification of polytypes – a reference to the fundamental paper of Kulpe & Schulz [*Krist. Techn.* (1972), **7**, 463] should also be given.

High-resolution electron microscopy of polytypes (J. van Landuyt, G. van Tendeloo & S. Amelinckx). An excellent contribution of great didactic value, giving fundamentals of the HREM technique and its application to various polytypic substances – not only those with close-packed structures. Some observations on mixed-layer structures are also presented.

Polytypism in rare-earth trialuminides (G. Schiffmacher). A short special paper dealing mainly with the polytypes of $DyAl_3$ studied by electron diffraction and the HREM technique.

The structural behaviour and physical properties of some MX_2 (CdI_2 *type*) *layered crystals* (A. M. Fernandez Samuel, Merra Rao & O. N. Srivastava). An extensive but rather

wordy article on the synthesis of CdI_2 polytypes and measurements of their dielectric constants and the synthesis of PbI_2 polytypes and determination of their band gaps. Polytypes of SnS_2 and TiS_2 are also briefly treated. The article contains qualitative explanations of the observed phenomena and it is commendable that non-periodic polytypes are also discussed.

Growth and characterization of AgI *polytypes* (P. R. Prager). A concise special paper on a relatively new 'relative' of SiC and ZnS (the same structural principle), including transformations of its polytypes and investigation of some physical properties.

The volume contains a fair subject and compound index. A detailed listing of contents would, however, serve the reader better than a mere list of contributions and their authors. An Appendix containing a list of substances recognized to date as polytypic would greatly increase its inspirational value. But the editorial work is otherwise well done and the inevitable overlaps (especially in the preliminaries) are not disturbing. The staff at Pergamon have produced a handsome book – its quick publication outweighs the shortcomings accompanying the photoprint technique used here.

The book is dedicated to Professor A. R. Verma who certainly deserves this for his pioneering work in polytypism. It is a must for everybody interested in this field. But it is also highly recommended to non-specialized crystallographers as well as to solid-state physicists – so that they are aware of what can be encountered and how it should be handled.

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Synthesis, crystal growth and characterisation. Edited by KRISHAN LAL. Pp. 568 + xii. Amsterdam: North Holland, 1982. Dfl 160.00, US $68.00.

This book is based on an International School held in New Delhi for two weeks in October 1981. The principal sponsor was the International Union of Crystallography with help from UNESCO and ten Indian organizations. The 140 participants were clearly given an excellent opportunity to learn about a wide range of subjects.

The volume contains 26 contributions, of which the first (Verma describing his work from 1950) and last (Kothari on the relation of modern physics to the two millenia old Indian concept of Syadvada) could be read with benefit by anyone with a general interest in science. The other 24 contributions are aimed primarily at materials scientists or people with a need to understand some of the problems faced by workers on essentially electronic materials. The authors have, in general, assumed that their audience was composed of graduates with reasonably broad backgrounds but anyone with a degree in physics, chemistry or materials science should be able to follow all the arguments. Many of the contributions could be read with benefit by third year undergraduates. In this respect the contribution by Mooser on physics in microelectronics should be particularly commended. The pair of contributions by Goodenough and Roy on solar power sources taken together give a good account of what can and *cannot* be expected.

The remaining papers give an adequate account of crystal growth and other preparation methods. The paper by Majorowski on growth at high pressures is the best short (26 pages) account that I have read. In 50 pages Paorici says nearly everything that needs to be said about melt growth and in only 16 pages Tolksdorf gives an excellent account of the growth of oxidic materials from high-temperature solutions.

X-ray, electron and neutron diffraction are the topic of 11 papers. The ones by Segmuller (measurement of strains and stresses) and Ranganathan (the structure of grain boundaries) are particularly useful accounts.

Electrical assessment is covered by Nag in perhaps too little detail (14 pages seems scarcely adequate). The book also lacks any account of the now extremely important methods for determining concentrations of individual impurities. Thus perhaps the title should be *Materials Preparation, Physical Assessment and Some Applications of Electronic Materials.* With this restriction the book can be recommended as background reading or as a source of further reading (most contributors give excellent bibliographies). Few people will need individual copies but most technical libraries should have one.

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Crystal symmetry: theory of colour crystallography. By M. A. JASWON and M. A. ROSE. Pp. 190. Chichester: Ellis Horwood, a division of Wiley, 1983. Price £18.50, paper £8.50, US$14.70.

It is well known that the theory of symmetry, which was logically completed in the classic work of Fedorov and Schönflies, is the theoretical fundamental of crystallography. The profound spread of the concept of symmetry into animate and inanimate natural science and into the ongoing process of its various generalizations is typical of the contemporary period of the development of theory.

In mathematical crystallography, the antisymmetry (two-colour) theory, which was mainly worked out by Shubnikov and other Soviet authors, takes a conspicuous place. The theory of symmetry and an introduction to antisymmetry concepts are included in many courses in the natural sciences departments of Universities. However, there is no universal textbook in which symmetry theory is set out in the intuitive-geometric plan with the grounding of group theory and with a logical transition to the antisymmetry concept. This gap is partly filled by the major work, *Symmetry in science, art and nature*, by Shubnikov & Koptsik