tions to the field of crystal growth, through technical achievements, publications and presentations, and their impact on science and technology in crystal growth worldwide. Those selected need not be citizens of the United States. Nomina-tions, together with concise supporting documentation, should be forwarded by 1 November 1977 to Dr E. A. Giess, AACG Awards Committee, IBM, T. J. Watson Research Center, Yorktown Heights, NY 10598, USA.

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.

Mössbauer effect methodology. Vol. 10. Edited by I. J. GRUVERMAN and C. W. SEIDEL. Pp. ix + 354. New York: Plenum, 1976. Price US$39.00.

The Mössbauer effect has become established as a useful tool for probing the solid state. This book, a collection of papers presented at a meeting held annually to discuss applications of the technique, shows that it is especially valuable when more conventional methods of study are difficult to apply. It contains papers in two main areas: catalysis and biological molecules. The change in chemical state of a surface Mössbauer atom (^{57}Fe, ^{119}Sn or ^{99}Ru) and sometimes in particle size can be monitored during a catalytic reaction, and this may have commercial use. In iron proteins the ligand-field levels of the iron atoms may be deduced from measurements of electric quadrupole and magnetic hyperfine interactions of ^{57}Fe and can give structural information. In both of these applications a small proportion of the Mössbauer isotopes can be detected and measured in the presence of a larger number of non-resonant atoms. The remaining papers give a good impression of current varied activity in physics and chemistry research in which Mössbauer spectroscopy is being used.

C. E. JOHNSON

Department of Physics
University of Liverpool
Liverpool L69 3BX
England

Méthodes physiques d'étude des minéraux et des matériaux solides. By J.-P. EBERHART. Pp. xiii + 507, Figs. 200, Tables 44. Paris: Doin, 1976. Price 580 FF.

Crystallographers tend to be very compartmentalized individuals. X-ray specialists are ignorant of electron diffraction, while electron microscopists know little about X-rays. It is therefore a pleasure to find a book about all the principal analytical methods based on the interaction of X-ray beams, electron beams and to a lesser extent neutron beams, with crystalline solids.

The first part (100 pp.) deals theoretically with the different radiations and with the nature of their interaction with atoms. The reviewer was surprised at the choice of some of the symbols used (*e.g. f* instead of ϱ for electron density, $\bar{q}$ instead of P for Patterson density and R instead of s for the reciprocal-lattice vector). The author was evidently faced with the difficulty that different conventions are used in X-ray, electron and neutron diffraction. In a second edition a glossary of symbols would be very useful.

Part two (50 pp.) deals with the production and measurement of radiation. The various counter methods of X-ray detection are described in more detail than is found in most textbooks and the reader is better able to compare the merits of the different detectors.

Part three (210 pp.) covers analytical applications of diffraction. In the chapters on X-ray diffraction the Laue, oscillation, Weissenberg and powder methods are discussed in detail. The section on powder diffraction is particularly extensive and treats identification and quantitative analysis of mixtures, lattice-parameter determination, grain-size measurement and preferred orientation. Single-crystal methods discussed include crystal orientation with Laue photographs, lattice-parameter and space-group determination and there is an introduction to structure determination. There is some confusion in the definition of the structure factor. On p. 241 F(hkl) includes the polarization factor but on the next page F(hkl) the coefficient in the Fourier series for electron density is defined as $F_m(hkl)/\sqrt{LP}$ where $F_m(hkl)$ is called the measured structure factor.

Electron diffraction and microscopy are treated together since a knowledge of scattering theory is essential for the interpretation of electron micrographs of crystals. High-resolution electron microscopy is full of pitfalls for the inexperienced who may describe as structural features what in fact are principally diffraction effects. Micrography of defects in crystals and low-energy electron diffraction (LEED) are also discussed.

The last part (100 pp.) treats spectroscopic methods of analysis. These are X-ray fluorescence, electron probe microanalysis, scanning electron microscopy, photoelectron spectroscopy (ESCA), Auger electron spectroscopy and secondary ion emission spectroscopy.

As far as the reviewer – an X-ray crystallographer – can judge, the specialist will learn little new about his own field although the theory is always explained clearly and rigorously and there is a wealth of technical hints. Eberhart's purpose appears to be to explain the different methods to specialists in other fields and in this he has succeeded admirably. At the end of each chapter is a book list; there is also a bibliography of original work (up to 1974). The clarity is enhanced by the excellent two-colour diagrams which are probably responsible for the very high price. English-speaking readers with school-standard French will find the linguistic effort well worth while.

G. S. D. KING

Laboratorium voor Kristallografie
Katholieke Universiteit Leuven
Belgium

X-ray diffraction topography. By B. K. TANNER. Pp. xiv + 174, Figs. 80, Tables 6. Oxford: Pergamon Press, 1976. Price $12.50, £6.25.

The book *X-ray diffraction topography* is written, as the author himself says, as an elementary treatment of X-ray topography comprehensible to the non-specialist.

In the first chapter the most important results of the dynamical theory, necessary for the understanding of topographic contrast, are presented in a short (and sometimes a little self-willed) way, not entirely free from minor mistakes and misprints.

The second chapter presents the most frequently used experimental techniques, especially the Lang technique. The reader will find not only the formulae for the estimation of optimum resolution, but also practical instructions for the adjustment of the crystal, the handling of the photographic plates, the conditions for optimizing exposures, *etc.* In a little less detail the Berg–Barrett method (in reflexion and transmission) and the double-crystal method (with symmetrical and asymmetrical reflexions) as well as most recent techniques (rapid high-resolution and direct-viewing topography, moiré topography, interferometry, topography with synchrotron radiation) are treated.

The following chapter shows how contrast on X-ray topographs can be interpreted by means of the dynamical theory. After considering wave fields in a perfect crystal which may produce *Pendellösung* fringes, the adaptation of the fields to a slightly distorted lattice is studied. The results of this consideration are then applied to the contrast of lattice defects such as dislocations, precipitates, stacking faults, twin and domain boundaries, growth bands, *etc.*

Chapter 4 gives some examples of a more detailed analysis of dislocations and planar defects, *i.e.* the determination of Burgers vectors, the study of dislocation movement and other properties of defects by means of X-ray topography.

The last three chapters are closely related to crystal growth. Topographical examples for aqueous-solution, hydrothermal, and flux growth are given, together with topographs from natural crystals such as diamond, quartz, calcite, topaz, mica and others. Finally melt growth, solid-state and vapour growth are considered.

For beginners in X-ray topography the greatest value of this book lies obviously in the two chapters on experimental techniques and on contrast, and in the numerous citations (about 600) which follow each chapter.

G. HILDEBRANDT

Fritz-Haber Institut
1 *Berlin* 33/*Dahlem*
Faradayweg 4–6
Germany

Space structures: their harmony and counterpoint. By ARTHUR L. LOEB. Pp. xviii + 169, Figs. 136, Tables 16. Reading, Mass.: Addison-Wesley, 1976. Price (cloth) $19.50, (paper) $9.50.

A crystallographer is generally introduced early to the geometry of three-dimensionally periodic lattices and the symmetry associated with them. These open up such a wide field of interest and complexity in their application to actual atomic arrangements in crystals that he may never stop to think of any more general geometry of structures – or, indeed, recognize the existence of 'structures' which are not crystal structures. If he does, he may assume (as did the reviewer before reading this book) that specialist mathematical knowledge is needed. Here, however, he is given a chance to learn otherwise. The basic concepts are very simple. The structures considered are closed figures having vertices, edges, faces, and cells (dimensionalities 0, 1, 2 and 3 respectively); it is the *numbers* of these elements which are

important, irrespective of straightness of edges, planarity of faces, or magnitudes (or even equality) of lengths and angles. 'Space is not a passive vacuum' says Dr Loeb in his *Introduction*, 'but has properties that impose powerful constraints on any structure that inhabits it. . . This book deals with the nature of these geometrical constraints, as well as with quantitative means of expressing them'. From obvious axioms – for example, that an edge ends in two vertices, and a face separates two cells, while a vertex may terminate any number of edges – the arguments are developed step by step, with the help of abundant diagrams and simple logic, to reach out into a variety of fields.

An idea of the book's scope may be given by mentioning some of the topics which most appealed to the reviewer. The requirements for rigidity in a polyhedron are obtained by considering degrees of freedom (formally very like the chemist's). While ordinary single-surfaced polyhedra count as two-dimensional structures, three-dimensional structures are shown to include curious figures such as the hyperoctahedron, which has internal vertices, edges and faces slung inside an ordinary octahedron; the model pictured almost tempts one to try making it for oneself! The enumeration of all regular two-dimensional structures gives as a byproduct a proof that an infinite tessellation of regular pentagons is impossible even on a non-planar surface. The conversion of polyhedra into one another, and the generation of new kinds of polyhedra, result from the processes of duality (replacing faces by vertices and *vice versa*), truncation (replacing edges and vertices by faces), and stellation (replacing edges and faces by vertices). Among the semiregular structures in particular, some fascinating patterns are found, notably the semiregular tessellation of pentagons, the quadrilateral hexacontahedron, and the snub cube. The names themselves are an entertainment – but why is the familiar rhombic dodecahedron disguised as the *rhombohedral* dodecahedron? Dirichlet domains in two dimensions are explained by comparison with medieval maps of parishes, each round its church; or with the school districts in Cambridge, Mass. But the relation of three-dimensional Dirichlet domains in a lattice to Brillouin zones is curiously never mentioned.

The later chapters on lattices are the least satisfactory. Though Dr Loeb knows well that a crystal structure is not the same thing as a lattice, his discussion assumes that it is always directly derivable from its lattice, and ignores the facts that most structures have numerous independent atomic position parameters, and that it is the presence and character of atomic interactions rather than mere contiguity of atoms which determine the significance of polyhedral edges. The definition of coordination polyhedron on p. 132 would not be generally acceptable; attempts to associate it with the lattice create confusion even for the rock salt structure. Nevertheless, the discussion in these chapters of the space-filling properties of polyhedra is of interest for its own sake, as well as for its probable relevance to metals and intermetallic structures; and, though not directly applicable to other structures where the important groupings of atoms are neither regular nor semiregular polyhedra, for these also it may very well serve to stimulate thought.

The book is well written and attractively produced. It is a worthwhile addition to any library, or to one's own bookshelf.

HELEN D. MEGAW

Girton College
University of Cambridge
England