of specific minerals. The first part has an oversimplified but not readily comprehended approach to electronic structure, followed by three very useful chapters entitled *Conduction Mechanism*, *Other Electronic Properties* and *Heterogeneity and the Semiconductor Electrolyte Interface.* All provide an extremely useful text for workers and teachers of mineral chemistry, flotation and hydrometallurgical chemistry.

The remaining sections describe the occurrences, the electronic and magnetic properties and the non-stoichiometry of various minerals including elements, sulphides, sulpharsenides and oxides. This is a useful source of data with many references but its utility would have been improved if the author had not taken a deliberate decision to employ units 'common in the literature' rather than convert to a consistent system such as the S.I. Apart from confusion to workers in the different fields many present-day students will not be familiar with c.g.s. units, especially for example e.m.u./g.

The type-setting is clear and legible despite being chosen for economic production in this age of high costs. The figures are clear and the tables concise; nevertheless a more uniform way of presentation of data would have been helpful. There seem to be a few obvious errors although of course numerical data needs checking against the original references. One obvious error is the suggestion on p. 7 that flotation agents are aqueous solutions of hydrocarbon.

The book will provide both a useful source of reference material on mineral properties as well as a useful text at postgraduate level for geochemists, hydrometallurgists and mineral processors, and perhaps at undergraduate finals level for chemistry and physics students interested in the solid state.

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Diffraction physics. By *John M. Cowley*. Pp. xii + 410. Amsterdam: North Holland, 1975. Price Dfl 135.00, U.S. $56.25.

The publication of this book is an important event in the world of optics and microscopy. The author has made many fundamental contributions to the theory and practice of electron microscopy and electron diffraction, and when such a person decides to put his thoughts together in a systematic way in a textbook. one looks forward to a work that should be outstanding.

With this book one is not disappointed. The author has surveyed his field in masterly fashion; he discusses diffraction and image formation with light, X-rays, neutrons and electrons, but, having laid down the general principles of these subjects, he has wisely decided to concentrate mainly on the last. He deals with kinematic and dynamic theories, diffraction by imperfect structures, diffuse scattering, the study of defects, and order–disorder phenomena, but subjects such as crystal-structure determination – on which many textbooks already exist – he dismisses very briefly indeed.

I am pleased to see that the author has adopted the approach that I have advocated over many years – introducing diffraction through the concept of the Fourier transform; this may sound complicated to those who have been brought up on Laue's equations and Bragg's law, but it does ultimately make the subject of diffraction more logical and self-consistent.

One subject of topical importance, to which the author has made considerable contributions, is given some prominence in the book – 'imaging of thin crystals' or what is often incorrectly called 'lattice imaging'. If a crystal of thickness about 100 Å is viewed in a good electron microscope, an image closely resembling the structure found by X-ray diffraction can be seen. Since the aim of electron microscopists has always been to exploit the ultimate resolution of their instrument by producing images of individual atoms, it looks as though their ambition is now about to be fulfilled.

I have, however, some doubts. Electrons interact with crystals; they are not just scattered by them. It would not therefore be expected that they should give the same image as X-rays. Electron microscopes suffer from extreme spherical aberration, which means that the relative phases of the diffracted beams are affected – again producing a different image. Finally, the best image is produced with an 'underfocusing' of about 900 Å, which I find rather puzzling. The unit cell *must* be correct since it is based merely on the relative positions of the orders of diffraction; but how does one know that the fine detail really represents atoms? I shall be convinced only when the instrument produces *new* information.

The book is well produced, although, presumably for economy, the lines of print are not 'justified'. The illustrations are fewer than I would have thought necessary, and some of the diagrams are rather small. Since also the text is somewhat mathematical in spite of the author's claim that he has 'avoided over-rigorous arguments and mathematical complexity', the book appears rather austere. This appearance, together with its extremely high price, might well discourage many readers. This is a pity because the book contains a great deal of good material that all students should make an effort to absorb.

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Crystal growth 1974. Proceedings of the 4th International Conference. Edité par *K. A. Jackson*, *N. Kato* et *J. B. Mullin*. Pp. xvi + 708, Figs. 681, Tableaux 71. Amsterdam: North Holland, 1974. Prix Dfl. 300.00, U.S. $115.50.

L'une des conférences inaugurales est intitulée: *Future Needs and Opportunities in Crystal Growth – Crystal Growth Toward the Year* 2000. Elle est due à R. A. Laudise.

Dans cette étude, documentée et teintée d'humour, R. A. Laudise note, par exemple, que le nombre de pages du *Journal of Crystal Growth* double tous les deux ans. Un tel indice, parmi d'autres, témoigne de l'intéret toujours croissant des physiciens du solide et des scientifiques de plusieurs bords pour la croissance cristalline.

Celle-ci doit fournir des cristaux de haut degré de définition et de perfection, en raison de leurs propriétés exploitables: électroniques, magnétiques, optiques, laser, IR, piézoélectriques, *etc.*

Le présent recueil rassemble 131 exposés (dont 74 d'auteurs japonais) répartis entre 18 sections. Ils traitent de la production améliorée de cristaux connus, ou de l'obtention d'espèces nouvelles dont on a défini par avance les propriétés spécifiques. Les rubriques les plus abondamment garnies en exposés concernent la croissance en phase vapeur (à caractère fréquemment épitaxique) et la croissance en bain fondu. En revanche, la croissance en solution à basse température, phénomène compliqué, est très peu abordée.

Certaines technologies décrites sont plus élaborées que dans le proche passé; tels sont les progrès de l'encapsulation liquide. D'autres sont nouvelles, par exemple une technique video pour l'observation des images topographiques X *in situ* et non *post facto*.

Les simulations sur ordinateur de la croissance aléatoire des atomes font l'objet de plusieurs mémoires approfondis.

Il faut aussi signaler que, dans ce recueil, la table des matières finale est structurée de façon originale et pratique.

En effet, le titre *Perfection of Crystals* ne renvoie pas seulement aux sections X et XIV; les 31 références énumerées se rapportent aussi à d'autres sections où il est question de perfection cristalline.

De même, sous le titre *Characterization Methods* on trouve que 21 méthodes ont été collationnées. Trois d'éntre elles sont les plus employées: la microscopie électronique (21 références), la diffraction X (17 références), la topographie X (16 références). En outre l'attention est attirée par l'electrodécoration, la microscopie infrarouge, les hologrames interférométriques, l'analyse par activation neutronique, *etc*.

Ces exemples, entre autres, montrent combien est ici aisée une recherche bibliographique spécifique.

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Crystallography and crystal defects. By *A. Kelly* and *G. W. Groves*. Pp. x + 428, Figs. 274, Tables 42. London: Longman, 1970, reprinted with corrections but without plates in Longman Text Format 1973. Price £3·00.

This textbook originates from lectures actually given by the authors, and combines in an original way an elementary exposition of classical crystallography (*i.e.* the structure of perfect crystals), an introduction to the structure of crystal defects observed in real crystals, surfaces and interfaces, dislocations and point defects, and finally an introduction to the geometrical aspects of deformation by slip, twinning and martensitic transformation.

The table of contents is as follows: Part one – *Perfect Crystals*: Lattice geometry; The stereographic projection and point groups; Crystal structures; Tensors. Part two – *Imperfect Crystals*: Stress, strain and elasticity; Glide; Dislocations; Dislocations in crystals; Point defects; Twinning; Martensitic transformations; Crystal interfaces. Appendices: Crystallographic calculations; Vector algebra and reciprocal lattice; Planar spacings and interplanar angles; Transformation of indices following a change of unit cell; Crystal structure data.

Seen as a book for students in crystallography, this volume provides a reasonable balance between the study of perfect and imperfect crystals. It emphasizes rightly that imperfections are a fact of life for real crystals, which one cannot forget, but that these defects have a geometry of their own, which can be as complex and fascinating as that of perfect crystals.

Within its scope, this book is certainly clearly written, and combines in a pleasing way a simple and practical geometrical analysis with references to actual physical applications directly useful to crystallographers or metallurgists. It is prudent enough in controversial subjects still to prove correct five years after its initial publication. A set of problems with their solutions for each chapter and a small bibliography make the book very suitable for teaching.

The scope of the book provides of course its own limitations. With its emphasis on structure and geometry, the book does not mention any method of observation, nor practically any physical properties except, for the defects, their energy of formation and their mobility. There is for instance no mention of processes such as strain hardening, creep or sintering. Some chapters have aged, notably those on the mobility of dislocations and point defects and those on surfaces and interfaces, especially the structure of grain boundaries. Finally it is surprising in such a book to see no specific mention, except in a vague reference, to twins with an axis of rotation.

These are however minor criticisms, and the reprinting of this textbook was amply justified.

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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.

Advances in quantum electronics, Vol. 3. Edited by *D. W. Goodwin*. Pp. xii + 473. London: Academic Press, 1975. Price £17.40, or $46.00.

This volume, by L. C. Balling, C. C. Davis and T. A. King consists of two sections only: *Optical pumping* (*ca* 150 pp.) and *Gaseous ion lasers* (*ca* 300 pp.), with little direct relevance to crystallography.

Flash radiography. By *F. Jamet* and *G. Thomer*. Pp. ix + 192. Amsterdam: Elsevier, 1976. Price Dfl 85.00 or $33.95.

The bulk of this publication is not connected with crystallography – although the systems for the generation of high intensity ($i = 10^4$ Å) short X-ray pulses (10^{-7} s) are interesting. However, fifteen pages at the end are on the use of these systems on diffracting materials, showing, for example, the changing powder pattern of a metal foil during explosion.