placer un classique de la spectroscopie X comme celui de Manne Siegbahn. Cependant le livre figurera dans la bibliothèque des laboratoires spécialisés ou en voie de le devenir. Il réunit une dizaine d'exposés par douze auteurs qualifiés dont l'éditeur lui-même.

Il est toujours difficile que ce type d'ouvrage assure à chaque lecteur le choix des thèmes et la présentation homogène, sans lacunes importantes ni redites inutiles, qu'il aurait souhaité y trouver.

Ici, après un premier chapitre à caractère introductif sur les spectres X par P. E. Best, les méthodes expérimentales sont exposées dans les chapitres 2 et 3: J. S. Thomsen traite de la spectroscopie X essentiellement par un et deux cristaux plans 'with particular emphasis on corrections and sources of errors which must be considered in obtaining highest accuracy'; J. R. Cuthill traite des spectromètres à réseau et de leur application en spectroscopie d'émission. Les éléments de la théorie des spectres sont donnés dans le chapitre 4: spectres d'émission, par G. A. Rooke et le chapitre 5, *Many-Body Effects*, par L. Hedin. Dans les chapitres suivants sont exposés les spectres d'absorption: chapitre 6, par L. V. Azaroff et D. M. Pease; puis le rayonnement synchrotron et applications: chapitre 7, par R. P. Madden; la spectroscopie des photoélectrons X: chapitre 8, par B. M. Hagström et Ch. S. Fadley; enfin dans le chapitre 9, D. J. Nagel et W. L. Baun exposent les effets de liaison sur les spectres X, en général. Deux appendices donnent quelques valeurs numériques de longueurs d'onde (d'après J. A. Bearden, dans son échelle A^*) et de niveaux d'énergie (K, L_I et M_I).

Chaque chapitre a son autonomie et s'adresse, semble-t-il, à des lecteurs de formation différente. Certains exposés seront utiles aux débutants convenablement éclairés; d'autres, comme le chapitre 5, seront lus avec intérêt par des spectroscopistes qualifiés. Alors que, par ailleurs, le livre gagnerait à des coupures, on peut regretter que le traitement des spectres des ions multiplement chargés dus, entre autres, au bombardement par particules positives ou à l'excitation par traversée de feuilles (beam-foil spectroscopy) n'ait pas fait l'objet d'un chapitre et soit à peine pris en considération, malgré son importance actuelle.

On ne saurait critiquer la bibliographie dont il nous est dit qu'elle n'est pas exhaustive. Des lacunes peuvent cependant être déplorées.

La présentation typographique du volume est très bonne. Il n'en est pas de même de sa présentation analytique: on peut s'étonner que la table des matières soit réduite à une liste des différentes parties (sans noms d'auteurs), sans aucun appel de leurs subdivisions et paragraphes; il est malaisé de se référer rapidement aux sujets traités et l'index lui-même ne facilite pas la tâche.

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The development of X-ray analysis. By *Sir Lawrence Bragg*. Pp. viii + 270, Figs. 151. London: Bell, 1975. Price £6.50.

The scope and aim of this beautiful book is best expressed by quoting the first paragraph of the Introduction which W. L. Bragg wrote shortly before his death on July 1st, 1971:

'This book does not claim to be a complete and up-to-date account of all the progress now being made in X-ray analysis in laboratories over the world. It is of a more historical and reminiscent nature. In describing each new advance I have chosen my examples and illustrations from the first work which broke new ground, rather than from the latest achievements. I have tried to see these advances in perspective, and recall the excitement and enthusiasm at the time as each new insight into the structure of matter was achieved, over the sixty years since X-ray analysis started.'

It is sad to think that W.L.B. did not live to enjoy the acclaim that this work of love and pride will undoubtedly receive by those familiar with the subject as well as by students who approach it for the first time.

Like his father W. H. Bragg (Sir William), W.L.B. is a master of simplified presentation of subjects which could easily be blurred by a mass of scientific detail or an attempt at being encyclopedic. His style is concise, yet clear. He stresses the essential steps in the development of crystal structure analysis from the first deciphering of the ZnS and NaCl structures, *via* the silicates and metals to the full analysis of protein structures like hemoglobin. In each of these steps W.L.B. has been a tenacious pioneer against great odds, clearing the way for a host of workers following in his path. The various chapters show up the principal ideas that brought about the sudden advances in the decoding of the information hidden in the X-ray diagrams. All the freshness of discovery is recalled in the examples of actual structure determinations which the author uses in his discussion. Introductory chapters on X-rays, on the principles of optical interference, and on symmetry prepare the reader for a course covering all the standard (non-algebraic) methods of crystal structure analysis. Mathematical derivations and formulae are replaced by a qualitative inspection into the physical causes leading up to the results. Any teacher offering a course on X-ray diffraction would do well to read this book carefully and to extract its physical argumentation. This is all the more advisable at a time when so often thinking is prone to be dominated by the computer.

The manuscript was practically finished only two weeks before Bragg's death, according to the foreword by his son. W.L.B.'s co-workers and friends, Henry Lipson and David Phillips, carried out the final editing. The book is a worthy legacy from a great scientist whose life's work opened up new continents.

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Semi-conducting ore minerals (Developments in economic geology 4). By *R. T. Shuey*. Pp. 415, Figs. 57, Tables 31. Amsterdam: Elsevier, 1975. Price DFl. 55.00.

This book has succeeded in its declared purpose of providing a comprehensive monograph on the semiconductor physics of ore minerals for geophysicists, geochemists and extractive metallurgists. It is, however, unlikely to prove as satisfactory for specialists in the solid state. The level of mathematics, especially the chapter on electronic structure, is pitched too low for the theoretical chemist or physicist, but may in other places be somewhat high for the average applied scientists at whom the book is aimed. Certainly the employment of the principles of chemical equilibrium as a basis for semiconductor theory rather than Fermi–Dirac statistics (for which this reviewer is thankful) would not please every theoretician.

The book is divided into several parts dealing with principles and the properties

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 tempéra-