Book Reviews

Works intended for notice in this column should be sent direct to the Editor (A.J.C. Wilson, Department of Physics, The University, Birmingham 15, England). As far as practicable books will be reviewed in a country different from that of publication.

X-ray determination of electron distributions. By RICHARD J. WEISS. Pp. xv+196. Amsterdam: North Holland Publishing Co. Price 65*s*.

This book presents a study of the problems of making X-ray scattering measurements, with an accuracy of order 1%, to determine electron distributions in gases and solids. The experimental and theoretical methods which are required for obtaining and interpreting such results from perfect and imperfect specimens and from single crystals, powders and gases are discussed. A detailed account of the many sources of systematic error impresses on the reader the need for meticulous care and it is not surprising that significant results of this accuracy have been obtained only for four gaseous elements, eight solid elements, and five simple compounds. However, these results represent a substantial achievement and have already raised new problems for the solid-state physicist. These problems are discussed in the light of other physical evidence on electron distributions and in particular the analysis of Compton line shapes is treated in detail as one of the X-ray scattering techniques. This will be an essential handbook for crystallographers interested in this type of measurement and required reading for physicists who may have to worry about the significance of the results. The former might not like the seven crystal systems described as the various crystal structures, and the latter might not like electromagnetic radiation emitted in a nuclear transition described as an X-ray, but the number of minor errors in fact is very small, and the standard of presentation and indexing is high.

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Melting and crystal structure. By A.R. UBBELOHDE. Pp. xi+325. London: Oxford University Press, 1965. Price 63 *s*.

There is no clear theory of melting and any treatment must present a large number of experimental results, many of doubtful significance, and discuss a large number of suggestive correlations, in the hope that some day these can be sifted and either discarded or knit into a coherent pattern. Professor Ubbelohde has produced a thorough and comprehensive treatment of melting which, because of its wide scope, is in itself a contribution to the study of the subject. Some introductory chapters on basic thermodynamics and the various vibrational and mechanical theories are followed by accounts of the melting of ionic crystals, metals, glasses, substances containing flexible molecules and polymers. There are also discussions of pre-melting and pre-freezing phenomena, of liquid crystals, of rate process in melting and of statistical theories.

The book is not easy to read, mainly because of the nature of the subject matter, but partly because explanations are offered in an oblique way so that they might puzzle the expert and confuse the novice. The discussion of X-ray diffraction results suffers particularly from this fault and the author appears to suggest that a liquid immediately above its freezing point will consist mainly of extensive microcrystalline regions of low perfection but that this structure may not have a significant effect on the X-ray scattering. There is no clear discussion of how a structure which is very different from that conventionally described can give an almost identical radial distribution function.

It is a key theme of the treatment that there are many different mechanisms of melting, the relative importance of which may depend on the structural details of the solid and liquid phases involved. In evaluating any of these mechanisms it has to be decided whether the process is discontinuous, in that one phase simply supplants another unrelated phase, or continuous in that the solid phase may become unstable to its own deformations or imperfections. The issues involved here are made clear, but Professor Ubbelohde clearly thinks that the second viewpoint is correct for most materials. Some of the discussion of premelting is not sufficiently critical: for example, results of authors who have not quoted the impurity levels of their materials are presented, without comment on this fact, as evidence of pre-melting, even although it is clearly explained that effects given by impure materials cannot give evidence about the behaviour of pure ones.

None of these critisisms should detract from the great value of this book. Because he has succeeded in the formidable task of giving a coherent account of this diverse and complicated subject Professor Ubbelohde has produced a book which is sure to be an essential source of reference and a stimulus to new thinking about melting.

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X-ray methods in the study of defects in single crystals. By J. AULEYTNER. Translated from the Polish by J. LECIEJEWICZ. Pp. x+264. Oxford: Pergamon Press, 1967. Price 63 *s*.

This first part of this book contains a review of dislocation theory (15 pages) and of X-ray diffraction theory (30 pages). Out of the following 180 pages only about 50 are concerned with direct (*i.e.* X-ray topographic) techniques for studying mosaic structure and dislocation configurations. A final chapter describes a microfocus X-ray tube constructed by the author, based on the Ehrenberg and Spear design.

The introductory theoretical reviews contain many typographic errors. Misleading, confused and fallacious statements also occur. In one paragraph (bottom of page 43 and top of page 44) there appear the three statements '... in the case of a perfect crystal thick enough for the multiple interaction between incident and scattered waves

to be neglected the coefficient of total reflection is smaller than for a thin crystal', 'Let us consider the reciprocal lattice of a mosaic crystal. The points of this lattice are diffuse due to the disorientation of the blocks', and 'The angular width of the area of total reflection for a perfect crystal is given by the following equation $\Delta\theta = 4\delta/\sin 2\theta_0$ where $\delta = 1 - n$, n being the index of refraction for X-rays'.

In the description of experimental methods the lion's share of space (70 pages) is taken by the author's oscillating-film spectrometer technique for studying the angular range of reflexion from crystals. This would not be exceptionable if other methods were dealt with conscientiously: in fact there are striking omissions of significant work emanating from both East and West. The chapter on topographic methods starts with an eight-page long description of very early experiments on anomalous transmission by Borrmann. The single page of unclear explanation of the Borrmann effect that follows serves quite inadequately to deal with this important topic. The theory of energy-flow refraction in slightly distorted crystals published by Penning and Polder in 1961, and the theoretical and experimental works that quickly stemmed from this, all pass unnoticed. Mistakes occur in the description of techniques developed by J.B. Newkirk and by the reviewer which imply either remarkable carelessness or failure of comprehension on the part of the author.

The half-tone illustrations are generally very poor.

The number of references cited, 112, is small considering the breadth of the field the book attempts to review. Excluding papers by the author, only a dozen references relate to publications dated later than 1960. In running through those items familiar to the reviewer, no fewer than *fifty-two* errors, inadequacies and inconsistencies were noted. Many of these are bad enough to cause delay and frustration: their impact will fall heavily on the reader who does not have a good library at his elbow, and who is consequently poorly placed for ferreting out papers when given garbled clues – and this is just the type of reader whom monographs should try and assist. The publishers have done service neither to science nor to their own reputation by issuing this unreliable, unbalanced and obsolescent text.

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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. Mention here does not necessarily preclude a full review at a later date.

Optical properties of minerals. A determinative table. By HORACE WINCHELL. Pp. ix+91. New York and London: Academic Press, 1965. Price 40 *s.*

This book provides up-to-date data for the optical identification of minerals without the use of restrictive methods or the precise measurements required for classification. It contains about a dozen pages of introductory notes, but the main part of the volume consists of tables and charts of the microscopical properties of minerals, based on refractive index, birefringence, and optic axial angle. It is claimed that the charts permit the identification of minerals of variable composition without difficulties connected with graphical discontinuities corresponding to changes of sign and so forth. The charts are applicable to observations on thin sections as well as on grains.

Physical properties of magnetically ordered crystals. By E.A. TUROV. Pp. xx+222. New York and London: Academic Press, 1965. Price not stated.

This book was originally published in Russian in 1963, and the translation has been prepared by A. Tybulewicz and S. Chomet. Its eleven chapters deal with General Phenomenological approach to the properties of nonconducting magnetic crystals, Ferromagnetism in uniaxial crystals, Temperature dependence of the magnetocrystalline anisotropy and of the magnetostriction of ferromagnets, Compensated collinear antiferromagnetism, General conditions for the existence of weak ferromagnetism in antiferromagnetic crystals, Weak ferromagnetism in uniaxial crystals of even antiferromagnetic structure with respect to the principal axis, Weak ferromagnetism in uniaxial crystals of odd antiferromagnetic structure with respect to the principal axis, Weak ferromagnetism in orthorhombic crystals, Magnetic resonance in weak ferromagnets, Noncollinear antiferromagnetism, and Ferromagnetism and antiferromagnetism in a system of two crystallographically nonequivalent magnetic sublattices.

The primary aim of the book is to consider a wide range of physical phenomena, using a unified phenomenological method based on the spin-wave theory. The author attempts to establish qualitative and quantitative relationships between the different effects in ferromagnets and antiferromagnets, and devotes special attention to 'weak' ferromagnetic effects. There are a hundred and forty-five references, mainly but not exclusively Russian, and a subject index.

Crystals. By P. KRATOCHVIL. Pp. 112. London: Iliffe, 1967. Price 15 *s.*

This little book is an English translation, by Aleš Fořt, of a book originally published in Czech in 1963. Its four chapters are The structure of matter, Crystal structure, The origin of crystals, and The properties of crystals and their application. It is an ambitious undertaking to cover such a wide field in solid-state physics and crystallography in a very restricted volume, and the attempt cannot be regarded as entirely successful. Optical properties of crystals, for example, are dealt with in less than three pages. Nevertheless, the book provides a very useful survey, from which the reader can progress to more ambitious works.