

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 65s.

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 63s.

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 pre-melting 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 criticisms 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 63s.

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