

The purpose of these schemes is to exchange information and to assist in data collection by automatic diffractometers and micro-densitometers.

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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.

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Diffraction for materials scientists. By *Jerald M. Schulz*. Pp. 287. Englewood Cliffs, New Jersey: Prentice-Hall, 1982. Price US \$ 47.20.

Diffraction of periodic waves such as X-rays, neutrons, electrons, phonons, etc. is much used by materials scientists in order to obtain information about various structural features of all kinds of materials. The underlying scattering theory is formally the same in all these cases. It is the aim of the present textbook to provide, first, a straight forward and clear description of the fundamentals of scattering theory, and then to show how any specific application can be directly deduced from theory by specifying the fundamental relations in the appropriate way.

According to this aim the first chapter gives an introduction to the fundamentals of the kinematic diffraction theory starting from first principles and providing the mathematical aids necessary in order to follow every step of the deductions. In a particular section the implicit assumptions underlying the kinematic theory are emphasized and are contrasted with the suppositions leading to the dynamical theory which is treated in a later chapter. The second chapter deals with scattering by gases and liquids. In the third chapter diffraction theory is applied to crystalline materials. Starting from the concept of the reciprocal lattice and the Ewald construction, the rotating-crystal method, the powder method, and the Laue method are treated, followed by sections on the structure factor, the effects of temperature, absorption, and geometrical intensity factors. Chapter five is devoted to crystal-structure analysis. The fundamentals of crystallography are treated briefly, followed by sections on the Patterson function and on Fourier syntheses. The phase problem is dealt with by the heavy-atom method, the replaceable-atom method, and by direct methods. Further sections are concerned with thermal motion, difference Fourier maps and refinement. The sixth chapter deals with disordered crystals such as solid solutions, spinodal decomposition, stacking faults, thermal diffuse scattering, and phonon spectra. The seventh chapter, finally, deals with particle-

size broadening and small-angle scattering.

The fourth chapter leaves the basis of the kinematical theory and deals with dynamical scattering theory. After developing the fundamentals of the theory, these are applied to understand image formation in electron microscopy and X-ray topographical methods which are also treated briefly in this chapter.

It is the declared aim of this textbook to give a mathematically closed and didactically well elaborated introduction to scattering and diffraction theory, starting from fundamental physical principles and developing the theory step by step, providing also the mathematics needed. In the reviewer's opinion this aim has been fully met. The text is well illustrated by numerous figures. The fundamental relations of diffraction theory deduced especially in chapters one and four (kinematical and dynamical theory) are specified step by step, thus leading the reader continuously from the general principles to specific applications. Each chapter is followed by a number of problems which the reader should be able to solve himself following the same lines of argument as shown in the text.

According to the concept of the book, applications of the general scattering theory to specific problems are meant as examples which should enable the reader to treat other problems by himself or to use successfully the more specific literature, a selection of which is given in bibliographies at the end of each chapter. The author has not tried to deal with all possible applications of diffraction theory which are of interest in the various fields of materials sciences. This would simply not be possible within the 287 pages of the book. So, for example, X-ray stress analysis or preferred orientation analysis (textures) are just mentioned in the introduction but not treated in detail.

A short selection of numerical tables such as scattering factors and absorption coefficients is added at the end of the book and an index helps the reader to find the most important items in the text.

In summary, it can be said that the book meets its aim to be a concise and didactically well elaborated introduction to the fundamentals of diffraction theory as needed by the materials scientist. It should be useful to students, lecturers and research workers.

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