Book Reviews

Works intended for notice in this column should be sent direct to the Editor (P. P. Ewald, Polytechnic Institute of Brooklyn, 99 Livingston Street, Brooklyn 2, N.Y., U.S.A.). As far as practicable books will be reviewed in a country different from that of publication.

Struktur und Eigenschaften der Krystalle. By HELMUT G. F. WINKLER. Pp. viii+258, with 62 figs. and 79 tables. Berlin; Göttingen; Heidelberg: Springer. 1950. Price DM. 16·80.

After a short introduction on macroscopic crystal symmetry, the book is divided into two parts entitled 'Crystal structure and properties', and 'Properties and crystal structure' respectively. As expressed in the preface, these topics form two different sections through the domain of crystallography: in the first part the different kinds of chemical bond, structure types and disorder phenomena are discussed; in the second part heat conduction, compressibility, thermal expansion, optical properties, hardness and cleavage are treated.

The classification of structures is different from that usually adopted. The basis is not the bond type but a scheme which, one might say, corresponds in crystal optics to the division into isotropic, negatively and positively birefringent crystals. The classification runs: isometric structures; layer structures and distinct layer structures; chain structures and distinct chain structures. Thus, for example, the closely connected rocksalt and calcite structures come under quite different categories, likewise the cubic and hexagonal close-packed arrangements, whilst, on the other hand, feldspar and rhombic sulphur come together in the chain-structure category. 'Die hier angewandte Systematik der Kristalgitter dient also nur dazu, dass bei ihnen beobachtete physikalische Verhalten ordnend dazu stellen. Sie ist durch die Art unserer Problemstellung bedingt und will und kann nicht die bewährte Systematik, z.B. der Silikate, die sich auf die Bauzusammenhänge gründet ersetzen.'

The author states that often the anisotropy of the structure is not visible from the atomic arrangement. One might remark that with structures in which this difficulty may be encountered, even the proposed strict empirical classification is not always unambiguous and independent of the property concerned. Thus the cleavage of selenium (p. 220) is incompatible with its assignment to the category of distinct chain structures (p. 119).

The book, which aims to fill a gap in the German literature, brings much information in an easily readable way.

A few suggestions for possible improvements in detail may follow. The style could gain in exactness: by 'velocity of the light in a layer' is always meant the velocity of the light vibration lying in the layer; and also in concinnity by avoiding useless repetitions, in which respect the volume of the book could be considerably reduced without any loss of content. A close packing with a period longer than the AB or ABC period of the simplest hexagonal or cubic piling is called *fehlgeordnet* (p. 142; the paper cited is not responsible for this confusion). On p. 134 it is stated that a change in modification by change of conditions is governed by the energy tending to be most favourable. However, two modifications changing in stability at a transition point do not change their energy relation! When interpreting the hardness of diamond on the 111 face (p. 212), the number of carbon bonds between subsequent planes being as 1 to 3 alternately, the *mean* number of bonds is taken to be responsible for the observed hardness, as first one plane should be ground off, next the other. This image seems rather tendentious. In the 20-page chapter on cleavage it is not mentioned that the (100) cleavage of the CsCl structure conflicts with the simple rules given, which are said to hold qualitatively in all cases. It is remarked (p. 228) that Niggli in 1941 pointed out the connexions between the (100) cleavage of rocksalt and the fact that only one of the six bonds per ion is disrupted by the cleavage; this statement must undoubtedly have been made many times before.

In the preface the author acknowledges his debt to some recent English books. It struck the reviewer that in the section on bond types (pp. 11–84) many passages were an almost literal translation of Evans's well-known *Crystal Chemistry*.

J. M. BIJVOET

van 't Hoff Laboratory
University of Utrecht
Netherlands

Untersuchungen über die Fouriersynthese der Ladungsverteilung in Kristallen. I. Verfahren und Geräte zur mehrdimensionalen Fouriersynthese. By W. DE BEAUCLAIR. Berlin: Akademie-Verlag. 1949. Price $4.50.

Untersuchungen über die Fouriersynthese der Ladungsverteilung in Kristallen. II. Phasenfaktorentafel zur kristallographischen zweidimensionalen Fouriersynthese in Punkten eines Achtundvierzigstel-Netzes. By W. DE BEAUCLAIR and U. SINOGOWITZ. Berlin: Akademie-Verlag. 1949. Price $11.40.

The first volume gives a brief and not sufficiently profound introduction to the principles of Fourier synthesis of crystal structures. Thus, for example, all that is explained of the phase problem is that a necessary condition for carrying out a Fourier synthesis is that $\rho(x, y, z)=\rho(-x, -y, -z)$ or $\rho(x, y)=\rho(-x, -y)$ in the three- and two-dimensional cases respectively. The author does not explain how this restricts the phase angles to the values 0 and $\pm\pi$, and that the determination of the signs of the amplitudes is the basic problem. All computational problems connected with the ambiguity of sign are completely neglected. Since Fourier syntheses have been carried out successfully even with general phase angles, and in view of the very good account given by the author of many electrical and mechanical devices, one regrets all the more that the phase problem has been completely omitted.

The discussion of the accuracy required for Fourier synthesis is also to be criticized. There is no reason why, in the case of a three-dimensional synthesis, the density of steps in the third dimension has to be less than in the other two dimensions. Furthermore, it is no common procedure to correct measured F values by interpolation; this can be done in some special cases only. The accuracy of ordinary measurements will not be better than a few percent at high intensities and 20–40% at very low

intensities. Thus the overall computational accuracy of 5%, which the author recommends, will be required for very precise determinations only.

In the main part of the book the author discusses the different methods for computing one-, two- and three-dimensional syntheses by direct calculation or by Hollerith machines, and other mechanical, electrical and optical devices. This part contains many interesting ideas and may give valuable suggestions to those who are concerned with the development of new equipment for Fourier synthesis, and, indeed, for everybody who has repeatedly to carry out such calculations.

The second volume consists of tables of the function $\cos 2\pi hx \cos 2\pi ky$ in steps of $\frac{2}{48}$ for x and y between 0 and $\frac{1}{2}$. The reviewer regrets to say that this table is only of very limited use. In many cases a step difference of $\frac{1}{24}$ is not sufficient; an efficient use of the table can be made only if $F_{hk}=F_{h\bar{k}}$; and, finally, the usual method of splitting the two-dimensional synthesis into one-dimensional series works faster. (In a special case (with $F_{h\bar{k}}=F_{hk}$) 99 multiplications and additions had to be carried out using the usual method but 144 using the table.) The table will, however, be found convenient for calculating the density at a few points of a projection or for checking a machine calculation at a few spots.

R. Brill.

Polytechnic Institute of Brooklyn
Brooklyn 2, N.Y., U.S.A.

Krystallometrisches Praktikum. Grundbegriffe und Untersuchungsmethoden. By R. Schroeder. Pp. viii+199 with 156 figs. Berlin; Göttingen; Heidelberg: Springer. 1950. Price DM. 15·60.

This book is intended as an introduction to crystal geometry and morphology, and in particular to the geometrical methods and notation of V. Goldschmidt, which the author considers to be of outstanding usefulness. The first half of the book deals with general principles. The approach is not meant to be rigidly theoretical but to lead up to practical application; a good deal of historical matter is included. Space-group theory and the geometry of infinite lattices are not dealt with. The second half of the book gives a very full account of the two-circle goniometer, with details of its use and examples of calculations. Throughout, Goldschmidt's notation and the gnomonic projection are used in preference to Miller indices and the stereographic projection. The Hermann–Mauguin point-group notation is mentioned but not used.

A book like this, advocating geometrical methods which are regarded by most crystallographers as outdated, can hope to be persuasive only if it presents them with elegance and clarity; this it notably fails to do. It is difficult to see for what type of reader its style is really suited. While the first half is not composed as a rigorous argument from clearly stated postulates and definitions, it is yet too formal to make much use of examples from actual or idealized crystals. The beginner is not helped to visualize the shapes which are being discussed, nor is he given adequate definitions to enable him to construct them formally for himself. Symmetry is defined in terms of crystal faces, not face normals, and the difficulty that actual crystals rarely grow with faces of perfectly equal size is not even mentioned till a late stage in the discussion, when it is not adequately dealt with. The Law of Constancy of Angles is never explicitly stated, and the Law of Rational Indices appears rather late in a form which typographical errors have made almost unintelligible. No definition is given of a zone, though the term is used freely. An outline of how axial ratios may be calculated from measured angles is given for the general case of triclinic crystals only, and is expressed in a way which confuses sides and angles of the spherical triangles under discussion. The formulae for solving spherical triangles are nowhere collected together or stated in general terms, but are introduced as required in the examples without explanation of their source, though elsewhere in the book it is thought necessary to give at length the analytical derivation of the equation to a straight line.

When all these faults of presentation are added to the persistent use of the clumsy Goldschmidt notation, it is clear that the book is not to be recommended to the uncritical acceptance of a beginner. It should be useful to the experienced crystallographer who wishes to know something about the other systems of notation which he may meet in the older literature. Some of the discussions may be illuminating to the teacher of crystallography, particularly in their historical aspect, even where he disagrees with the author's conclusions. The detailed treatment of the two-circle goniometer, though somewhat ponderous, might perhaps be of use to anyone embarking on a series of systematic measurements.

The paragraphing throughout the book makes for difficult reading; the practice of making each sentence a separate paragraph destroys altogether the coherence of the arguments. Equations are not numbered, so that cross-reference is impossible. There are a good many slips and printer's errors.

H. D. Megaw

Crystallographic Laboratory
Cavendish Laboratory
Cambridge, England

Books Received

The undermentioned works have been received by the Editors. Mention here does not preclude review at a later date.

Optical Crystallography. By E. E. Wahlstrom. Pp. 247, with numerous illustrations. New York: Wiley; London: Chapman and Hall. 2nd ed. 1951. Price \$4·50; 36*s*.

Elements of Optical Mineralogy. Part II. Descriptions of Minerals. By A. N. Winchell and H. Winchell. Pp. xvi+551, with 427 figs. New York: Wiley; London: Chapman and Hall. 4th ed. 1951. Price \$12·50; 100*s*.

The Interpretation of X-ray Diffraction Photographs. By N. F. M. Henry, H. Lipson and W. A. Wooster. Pp. ix+258, with numerous figs. and tables. London: Macmillan. 1951. Price 42*s*.