Moreover, solution of linear equations (3) yields the direct-lattice components $p_k^{(r)}$ of the principal-axis vectors. These will sometimes be preferred to the components $q_k^{(r)}$.

Derivation of equations (2) and (3) is most convenient in matrix notation. Equations (1) may be written

$$(\mathbf{B}-\lambda\mathbf{g})\mathbf{q} = 0, \quad \mathbf{g} = [\mathbf{b}_i.\mathbf{b}_j]\,. \qquad (1a)$$

Taking the scalar product of (4) with $\mathbf{b}_j$, and noting that $\mathbf{a}_i.\mathbf{b}_j = \delta_{ij}$, yields $\mathbf{p} = \mathbf{g}\mathbf{q}$. A similar product of (4) with $\mathbf{a}_j$ shows that $\mathbf{g}^{-1} = [\mathbf{a}_i.\mathbf{a}_j]$, since $\mathbf{q} = \mathbf{g}^{-1}\mathbf{p}$.

Premultiplying (1a) by $\mathbf{g}^{-1}$ gives

$$(\mathbf{g}^{-1}\mathbf{B}-\mathbf{g}^{-1}\lambda\mathbf{g})\mathbf{q} = (\mathbf{g}^{-1}\mathbf{B}-\lambda\mathbf{1})\mathbf{q} = 0\,. \qquad (2a)$$

Substituting $\mathbf{q} = \mathbf{g}^{-1}\mathbf{p}$ into (1a) yields

$$(\mathbf{B}-\lambda\mathbf{g})\mathbf{g}^{-1}\mathbf{p} = (\mathbf{B}\mathbf{g}^{-1}-\lambda\mathbf{1})\mathbf{p} = 0\,. \qquad (3a)$$

These are the matrix equivalents of equations (2) and (3).

Criticism and suggestions from Prof. J. Waser and Prof. V. Schomaker are gratefully acknowledged.

Reference

WASER, J. (1955). *Acta Cryst.* 8, 731.

Notes and News

Announcements and other items of crystallographic interest will be published under this heading at the discretion of the Editorial Board. Copy should be sent direcct to the Editor (P. P. Ewald, Polytechnic Institute of Brooklyn, 333 Jay Street, Brooklyn 1, N.Y., U.S.A.) or to the Technical Editor (R. W. Asmussen, Chemical Laboratory B of the Technical University of Denmark, Sølvgade 83, Copenhagen K, Denmark)

The X-ray Powder Data File

Upon the resignation of Dr G. W. Brindley, Dr J. V. Smith has been appointed acting Editor to the X-ray Powder Data File. New data and information concerning errors in the published data are always welcome and correspondence should be addressed to Dr J. V. Smith, Mineral Science Building, The Pennsylvania State University, University Park, Pennsylvania, U.S.A.

Book Reviews

Works intended for notice in this column should be sent direct to the Editor (P. P. Ewald, Polytechnic Institute of Brooklyn, 333, Jay Street, Brooklyn 1, N.Y., U.S.A.). As far as practicable books will be reviewed in a country different from that of publication.

Solid State Physics. Advances in Research and Applications. Volume 4. Edited by F. SEITZ and D. TURNBULL. Pp. xiv+540 with many figs. New York: Academic Press; London: Academic Books. 1957. Price $12·00; £4·16.0.

This volume contains five articles, of which two, 'Ferroelectrics and antiferroelectrics' by W. Känzig (197 pages) and 'Techniques of zone melting and crystal growing' by W. G. Pfann (100 pages) are reviewed here. The others are 'Theory of mobility of electrons in solids' by F. J. Blatt (168 pages), 'The orthogonalized plane-wave method' by T. O. Woodruff (45 pages), and a 'Bibliography of atomic wave-functions' by R. S. Knox (9 pages).

Ferroelectricity is the existence of reversible spontaneous polarization in a dielectric; antiferroelectricity, less easy to define macroscopically, has its origin in permanent dipole moments associated with symmetry-equivalent parts of the structure, whose resultant moment is zero. The technological importance of ferroelectrics has inspired a large amount of fundamental work, but the results are scattered through the literature, so that it is not easy for anyone who wants an up-to-date picture to assemble it for himself. Dr Känzig's monograph therefore meets a real need. It is comprehensive, authoritative, and written with a sense of order and attention to detail which make it a valuable work of reference. It includes a long and important section on the physical properties of single crystals; an account (perhaps too short for clarity) of the phenomenological theories; discussion of domain effects; descriptions of crystal structures, as known from X-ray and neutron diffraction, infra-red and Raman spectroscopy, and nuclear magnetic resonance; brief notes on solid solutions; and a summary of the various model theories. New ferroelectrics discovered up to 1957 are included. Full references are given (though, regrettably, as footnotes). The article is no mere compilation of results and theories. Trouble has been taken to sort them into logical order, to express them in forms which allow comparison, to assess their reliability and interpret their significance. This of course enhances their value. Indeed, not the least valuable parts of the article are some of these interpretations (though it is sometimes not clear from the text just how much is due to Dr Känzig rather than to the original author).

The article is likely to be of most value to those who already have some knowledge of ferroelectricity and want to extend it. It cannot be recommended without reserve as an introduction to the subject, partly because explanations are kept short, and partly because of limitations inherent in the conventional solid-state approach. Solid-state physics, generally concerned with very simple structures where the atoms are all in special positions, has developed techniques of handling them in terms of translation-equivalent arrays of atoms, so-called 'sub-lattices'. In such simple structures, small changes are of the nature of homogeneous distortions, and can be dealt with by treatments which are effectively macroscopic. Dr Känzig follows this method; thus, for example, dimensional changes at transitions are introduced in the first instance as strains superposed on the high-symmetry structure. To the crystallographer, accustomed to structures where relative atomic positions are not fixed by the cell dimensions, this approach seems artificially restricted. The analysis into 'sub-lattices' is incapable of dealing with symmetry operations inside the unit cell. In antiferroelectrics, where such operations play an important part, consideration of them is by-passed, and their significance obscured, by introduction of the idea of 'superstructures' of an idealized small cell. The immediate disadvantages of allowing this description (which is only easy so long as it is left vague) to replace the much more powerful description in terms of the true (large) unit cell and its symmetry elements are twofold: it creates an artificial verbal distinction between antiferroelectrics and more familiar materials (and thereby conceals their interest for the crystallographer); and it makes it much harder to recognize how the polarization or antipolarization of the phenomenological theories should be allocated to individual units of the structure. In spite of this weakness in his treatment, Dr Känzig's descriptions of crystal structures are careful and generally reliable. An exception to this is the rather confused treatment of the periodates, which involves the unwarranted assumption that the antiferroelectric form necessarily has antiparallel dipoles. The discussion of these structures is so speculative as to be out of place in a review of this kind. It is given additional uncertainty by a serious misunderstanding about the space group. The arrangement of octahedra shown on p. 157 for the high-temperature form is inconsistent (even as an approximation) with the space group $R\bar{3}m$ reported in the literature for $Ag_2H_3IO_6$, because the symmetry planes of the octahedra do not coincide with possible symmetry planes of the lattice. It may well be the space group that is wrong, but the experimental evidence for this would need to be more fully known before discussion is worth while.

There are very few misprints or numerical errors—the date 1954 instead of 1952 for the work of Wood, Merz & Matthias on $ND_4D_2PO_4$ is a rare example. A few verbal errors recur—'different than' instead of 'different from', 'substitution of H by D' instead of 'replacement of H by D' or 'substitution of D for H', 'it is remarkable that' instead of 'it is worth noting that', 'dipolar energy' instead of 'dipole energy', and that persistent and confusing mistake, 'lattice' instead of 'structure' or 'array of atoms'. But points such as these are only small defects in an account which is otherwise clear, readable, and exact, and likely to be of lasting value.

The other article of crystallographic interest is that on zone melting. Zone melting is a method of preparing crystalline materials of very high purity, or very accurately controlled impurity; it may be combined with, or adapted to, the growing of single crystals. Most work has hitherto been done on silicon, germanium, and certain metals; but the methods are of wider applicability, and some results have been obtained with organic materials. Dr Pfann's article contains a readable account of the general principles, together with detailed discussion of existing techniques and possible developments. There should be useful ideas here for anyone concerned with growing crystals. The general reader may be astonished to learn just how accurately any desired variation of composition (and properties) can be placed in a crystal. A section is included dealing with the way dislocations arise during growth, and methods of observing them.

The volume is well produced, with numerous and well chosen diagrams. The subject index is so incomplete and inconsistent as to be almost useless.

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Structure des Métaux. Par C. S. Barrett. (Traduit par C. Leymonie, Préface de P. Lacombe). Pp. xvii+618. Paris: Dunod. 1957. Prix 7.900 f.

Il n'est pas besoin de faire une critique du livre de Barrett, car les lecteurs de ces lignes ont en majorité déjà éprouvé par eux-mêmes les qualités de ce livre. C'est donc uniquement de la traduction française qu'il sera question ici.

Il est évident aujourd'hui que tous les chercheurs avancés de langue française doivent lire l'anglais sans difficulté. Il est donc inutile de traduire des ouvrages spécialisés d'un niveau élevé. La traduction doit être réservée à des ouvrages s'adressant à un public étendu en dehors des laboratoires de recherches. D'autre part, si on la fait, la traduction doit être assez bonne pour que les lecteurs sachant l'anglais ne soient pas tentés de revenir à l'original.

Ces deux conditions sont parfaitement remplies dans le cas qui nous occupe. Nous nous réjouissons que tous ceux, étudiants et ingénieurs, qui étaient privés des ressources du 'Barrett' par l'obstacle de la langue puissent maintenant en profiter et l'édition française est particulièrement réussie. La présentation, en particulier pour les figures et les clichés, ne le cède en rien à celle de l'original. Quant au traducteur, il a montré qu'il sait non seulement l'anglais mais aussi le français: le style est aisé et sans anglicismes. Ayant comparé phrase par phrase d'assez longs passages des deux textes, je peux témoigner que la traduction est très correcte (je n'ai trouvé de discutable que 'articles de revue' pour 'articles de mise au point'). Je n'ai pas même trouvé de fautes d'impression et l'on sait pourtant que celles-ci scintillent sous l'œil du critique alors qu'elles se cachent avec obstination à l'auteur relisant ses épreuves.

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