

An introduction to crystal chemistry. By R. C.

EVANS. 410 pp. Cambridge Univ. Press. 2nd ed.
Price 52s. 6d. (\$9.50).

This is a new edition of the well known textbook originally published in 1939. As the author rightly says in the preface, the principles laid down 25 years ago have taken their rightful place as an integral part of modern structural chemistry. It is also true, and not a little disturbing, to realize that although we have solved many more crystal structures in 25 years we have not made anything like as much progress in understanding them. Between the two extremes of ionic and covalent crystals we still have that vast no man's land where '... the bonding is obscure, but it is probable that the $A-X$ bonds are primarily covalent ...'. This makes the classification of crystal structures a difficult task and Dr Evans handles it masterfully.

The book falls, as did the first edition, into two parts: I. *General principles of crystal architecture* (115 pp.), II. *Systematic crystal chemistry* (277 pp.). The only substantial change in part I is a fuller discussion of hybrid orbitals (suggested by Pauling in 1931 and mentioned briefly in the first edition). There is some discussion of the valence-bond and molecular-orbital approximations, but this is purely descriptive and not easy to follow; in any case most structures are discussed in terms of resonance hybrids.

The diagrams have been specially drawn and are excellent. Each diagram is labelled with crystallographic axes and often there are fractional coordinates marked on the atoms. This is good, for it might encourage students to build models. In this connection much could be said for lengthening and moving the appendix on *Representation of crystal structures* to the beginning of part II. As it is, the text assumes a substantial familiarity with elementary crystallography and uses terms baffling to the uninitiated. Also although the cross referencing on the whole is very good, not every effort was made to help the reader find his way about; the early parts of the book use the ideas of isomorphism and of polymorphism fairly liberally without directing the reader's attention to the special sections devoted to these topics.

With a text book such as this it is never easy to know where to draw the line: where does crystal chemistry end, and solid-state physics begin? Dr Evans seems to have fairly strong views on this. In connection with the perovskites the word ferroelectric is mentioned (p. 167) but we are not told what this means or how it arises. We are treated to n - and p -type semi-conductors (p. 211) but do not get to transistors. The descriptive parts on disorder and defects are very good, but the author is clearly not keen to get involved in anything savouring

of thermodynamics and the reader will not learn anything of the dominant role played by entropy in these phenomena. (Perhaps the chemical principles mentioned on p. 8 do not include thermodynamics?) The only energy considerations appear to be restricted to *potential* energy so that why (as opposed to how) crystals exhibit polymorphism is left unanswered. Incidentally, we still have the old heresy (p. 26) that 'potassium readily forms an ion' (what, after all, is a mere 100 kcal. mol⁻¹?), but in fairness the importance of lattice energy is later stressed (p. 52). The author is not only anxious to avoid straying too far into physics, he has some inhibitions about chemistry also. True, one has to keep the subject within bounds, but trying to follow discussions on solid solutions and compound formation without phase diagrams is hard going. Anyone who makes much of the Fe-C phase equilibria without a diagram (pp. 348-351) must surely have known it already. One wonders also why all mention of polymers has been dropped. And surely, even though they may not illustrate any new structural principles, vitamin B₁₂ and myoglobin are interesting enough to be included in a book on crystal chemistry. There is also no hint as to how ligand field theory has improved our understanding of transitional element crystal chemistry. Nor strangely enough is there as much as a word on the fascinating magnetic structures described by Bacon in his recent book *Applications of neutron diffraction in chemistry*.

This edition, unlike the first, does not contain references to original papers and this was probably a wise decision. There is, however, a useful bibliography and some very good summary tables, sensibly indexed at the front of the book. The index at the back has minor hazards for the unwary. Thus Al₂O₃ is not there, as the heading warns you it might not be. Nor can it be found as A₂X₃. However, one can track it down under *Oxides*, A₂O₃.

For a new edition there are incredibly few typographical errors. This reviewer found only four and the fact that forsterite, Mg₂SiO₄, has Fe atoms in place of Mg atoms (Fig. 11.04) will not alarm many readers for long. Although one might feel that the author could have ranged wider he has produced a very good introduction to crystal chemistry. It is eminently readable and reasonably priced. Anyone who got to know, and like, the first edition will certainly get a copy of the new edition.

S. C. NYBURG

Department of Chemistry
Lash Miller Chemical Laboratory
University of Toronto
Toronto 5
Ontario
Canada