
Out of the conviction that "... the crystal chemistry of metals is something that can be approached in its own right" (p. vi), Pearson has written a volume that combines extensive discussion of the chemical and physical factors that influence the formation of particular structures (chapters 1 through 6, 300 pages) with descriptions of some six hundred metal and alloy structure types (chapters 7 through 16, almost 500 pages). Throughout the book organizational and descriptive emphasis rests on stacking of atomic layers. Within this scheme the close-packed layer becomes just one specialization of two-dimensional nets of atoms.

Chapter 7 deals with structures based on close packing of close-packed nets, while chapter 8 discusses many structures formed by filling of tetrahedral, octahedral, or other interstices in close-packed arrays. Here are found, among others, descriptions of structures derived in any of several ways from the sphalerite, wurtzite, fluorite, halite, and NiAs structure types. Further chapters describe structures based on triangular prismatic coordination, body-centered cubic packing, and arrangements of complex atomic layers including square-triangle nets, kagomé nets, and nets yielding idiosyncratic coordination polyhedra or bonds are more useful than the equally numerous two-dimensional projections. There are no stereoscopic diagrams. Each structure description contains at least one reference to the original literature; these are generally up to date through the late 1960's, although in a few cases reference is made only to an early Strukturbuch volume. The minerals included in this compendium are restricted, with few exceptions, to those exhibiting metallic or semiconducting properties. Understandably the coverage is neither mineralogically comprehensive nor consistent. Although, for example, both troilite and smithrite are described, there is no mention of pyrrhotite.

In his first six chapters Pearson discusses the crystal chemistry of metals and alloys with the objectives of rationalizing his own scheme of classification and description of structural units, and of evaluating the various factors that influence the stability of particular structure types. The interested mineralogist will profit from Pearson's attempt to interrelate geometrical factors like coordination, atomic size, and packing with chemical bonding considerations arising from electronegativity differences and energy band factors. The systematics of sulfide and sulfosalt mineralogy are not well understood, compared, say, to silicates, precisely because no one simplistic structural model can accommodate adequately to the complex interplay of competing influences. In this sense the classical crystal chemistry frequently presented to mineralogy students is woefully inadequate, and more exposure to the kind of analysis these chapters exemplify could improve the students' grasp of the subject significantly. The reader must, however, turn elsewhere for the fundamentals of the electron theory of metals and valence bond theory; suitable references are given in the text.

Chapter Five, "Valence compounds of metalloids: crystal chemistry of semiconductors," is perhaps the most satisfying of the entire book. After contrasting metallic and semiconductor bonds, and describing the bonding characteristics of several semiconducting structures, Pearson compares metals, semiconductors, and compound structures. Here one begins to appreciate in a way that simply doesn't come across in more classical crystal chemistry texts how size, chemical bond, and electronic factors interact to determine structure type. The chapter ends with a discussion of crystal field effects in transition metal compounds that is brief but gives several detailed illustrations of, for example, phases exhibiting Jahn-Teller distortions, as well as appropriate literature references.

In spite of my impression that this book's treatment of crystal chemistry is well worth the mineralogist's attention, I can not recommend it to students as anything beyond a reference work for structure types and access to the literature. The intellectual impact is seriously impaired, in my opinion, by a writing style that is extraordinarily awkward and confusing. Clumsily constructed sentences require perseverance and dedication if the reader is to appreciate fully Pearson's obviously skilled grasp of the subject. It is too bad such scientific insight is so obscured in the "noise" of the communication medium. The book will, nonetheless, be a useful addition to institutional mineralogical libraries.

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CLAY MINERALS: A GUIDE TO THEIR X-RAY IDENTIFICATION. By Dorothy Carroll. The Geological Society of America. Special Paper 126. 80 pages. $3.00.

Techniques of separating, mounting, and X-ray diffraction analysis of clays, as these were employed by the author, are described in this book. In addition, brief descriptions of the principal clay minerals and some comments on the origin and weathering of these minerals are presented. Mass absorption coefficients, calculated by the author for 25 clay minerals or minerals sometimes associated with clays, as well as numerous useful tables and diagrams from the literature, are presented. The book should be useful to
n summarize, the book by Daniel Maclnnes provides an extensive reference for industrial gem and mineral producers and their technical staffs, but mineralogists may find it disappointing. It is a splendid addition to the library of those who have a deep interest in gemstones.

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Noyes Data Corporation specializes in publishing technical reviews and handbooks, and this book by Daniel Maclnnes is little more than a compilation of 112 of the more important patents issued for gem manufacture since 1911 when A. V. L. Verneuil obtained protection of the U.S. Patent Office for his eminently successful process for synthesizing sapphire by flame fusion.

There are 14 patents listed for the synthesis of corundum, 5 for “gems” with asterism, 8 for rutile, 12 for titanates, 8 for garnets (including the important laser crystal, YAG), and 9 for a variety of “gems” ranging from jade to cat’s eye and from opal and lapis lazuli to emerald. More than half of the book (116 pages) is devoted to 35 processes for synthesizing diamonds, beginning with the famous Hall method first announced to De Beer’s and the world by the General Electric Company in 1955 (but not granted patent protection until 1960) and ending with a most recent patent (July, 1972) obtained by George C. Kennedy.

In this book the author (compiler) has attained his stated purpose: “to describe the number of technical possibilities available” for synthesis of gems and related crystals. However, I disagree with his statement that “One should have to go no further than this book to establish a sound background before launching into research in this field.” Although the book contains an abundance of technical detail (including 41 elaborately detailed figures of apparatus, furnaces, and process-related miscellany), there has been no attempt by the author to extract and systematize the vast body of scientific knowledge that underlies these remarkable technical accomplishments. The book will be a handy reference for industrial gem and mineral producers and their technical staffs, but mineralogists may find it disappointing.

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