
BOOK REVIEW

Introduction to Mineral Sciences

*Reviewed by Eugene C. Robertson, U.S.
Geological Survey, Reston, VA 22092*

REFERENCE: Putnis, Andrew, *Introduction to Mineral Sciences*, Cambridge University Press, New York, 1992, 457 pp.

This unusual book on minerals contains descriptions of mineral physics and chemistry and of mineral stability and transformations under conditions in the earth's interior. After a preliminary discussion of all aspects of the locations of atoms in minerals, the author describes the solid state stability and the transformations of minerals, including basic concepts in thermodynamics, diffusion, and kinetics. The author's approach is to provide an understanding of mineral crystal symmetry and structure and of chemical composition changes occurring in geologic processes. The contrast between this eclectic approach to mineralogy and the usual systematic descriptions of minerals and their properties will be startling to practicing geologists.

The author states that he has written the book for undergraduates with a normal training in physics, chemistry, and mathematics and enrolled in earth science, with pertinence to students in materials science. However, most subjects covered in the book are fairly sophisticated, and although the author does not present rigorous mathematical developments, he does condense many subjects rather tightly for easy undergraduate comprehension. Nearly contemporaneous training in descriptive mineralogy and physical chemistry is needed.

The first portion of the book is devoted to crystallography, optical properties, X-ray and electron diffraction, and all the modern spectroscopic methods for identifying atom locations, valence states, and chemical groups. Bonding and geometric groupings are described in two chapters on crystal structure; emphasis is on silicate minerals and their structural classification. Defects, dislocations, and twinning in mineral crystal structures are well described. In these chapters, the photomicrographs and drawings are well chosen and at a comfortably large scale.

The last half of the book is concerned with solid state transformations in minerals as affected by pressure, temperature, and pertinent chemical changes. Solid state reactions between minerals and reactions between minerals and fluids are only touched upon. Thermodynamic principles are presented in requisite detail for comprehension, and mineral stability relations, solid solutions, exsolution, and order-disorder relations are described. The theory and some applications of the kinetics of mineral processes are succinctly but adequately described. In the final two chapters, phase transformations by exsolution and by polymorphic transitions including displacive, reconstructive, and order-disorder are described. The figures in this half of the book are also well chosen.

Almost every important aspect of solid state mineralogical processes in the earth is covered in the book. It is a textbook intended for students of earth science who have access to additional training in determinative mineralogy and petrology. As such, it provides an entree to later study of sophisticated mineral physics and mineral chemistry applied to processes in the earth's interior.

A number of books on mineral physics that include crystallography, physical properties, and elementary thermodynamics have appeared in the last 30 years, but most contain more rigorous developments of topics than this book and they are narrower in scope. Discussions of solid state behavior of minerals undergoing geological processes are not provided in the older books. Putnis systematically planned and carefully wrote for college students in earth science who would find other collections of papers on these subjects by many authors much more difficult to absorb. The book is reasonably clearly written, but given the rather complex subject matter and the succinct treatment, careful study is required by the reader. The book has a large format, and the figures are large and illustrate the text well. Perhaps its major drawback as a textbook is the large number of topics covered and its great length.

This book can be very useful to a professional earth scientist whose training was more than ten years ago and who wants to understand current publications on mineral transformations in the earth.