

## BOOK REVIEW

**MICROSCOPIC TO MACROSCOPIC; ATOMIC ENVIRONMENTS TO MINERAL THERMODYNAMICS** (S.W. Kieffer & A. Navrotsky, eds.). *Reviews in Mineralogy*, volume 14, 1985, 428 pages. Publisher: The Mineralogical Society of America. Cost: \$13 (U.S.)

This welcome volume maintains and enhances the high quality of the series 'Reviews in Mineralogy' edited by Paul H. Ribbe. The book consists of eleven chapters written by ten authors. Their objective is to show the reader the connections between the microscopic properties of crystals, such as vibrational spectra, lattice dynamics, crystal-field spectra, and their macroscopic counterparts, such as their classical thermodynamic properties and resulting macroscopic behavior in terms of order-disorder, exsolution, and phase equilibrium.

The objective is well achieved, although the reader will have to devote some effort to the task of following the arguments and explanations in detail. Indeed, the subject is intrinsically one of detail, and cannot be appreciated in a practical sense without it. Most of the readers who will find this book valuable will be those who already have a reasonable working knowledge of classical thermodynamics and its macroscopic consequences, and who have come to feel the need for understanding the fundamental processes in minerals that underlie the macroscopic properties. Without this understanding it is not possible to predict thermodynamic properties and mineral stability from a fundamental basis.

Each of the eleven chapters is really a small book in itself, and to review each in detail would take an unreasonably long article. The authors are all well-known in 'fundamental mineralogy' circles and have put together chapters that are, for the most part, truly instructional. It is perfectly possible to use this book to self-educate yourself, although most will find it necessary to refer to some of the suggested references in quantum mechanics, statistical mechanics, and solid-state physics. For my own part, I expect to be learning from this book for several years.

The chapters and their authors are:

**CHAPTER 1. Scientific Perspective.**

Susan Werner Kieffer and Alexandra Navrotsky.

**CHAPTER 2. Vibrational Spectroscopy in the Mineral Sciences.**  
Paul McMillan.

**CHAPTER 3. Heat Capacity and Entropy: Systematic Relations to Lattice Vibrations.**  
Susan Werner Kieffer.

**CHAPTER 4. Lattice Dynamics, Phase Transitions, and Soft Modes.**  
Subrata Ghose.

**CHAPTER 5. Symmetry Aspects of Order-Disorder and the Application of Landau Theory.**  
J.D.C. McConnell.

**CHAPTER 6. Order-Disorder Transformations in Mineral Solid Solutions.**  
Michael A. Carpenter.

**CHAPTER 7. Crystal-Chemical Constraints on the Thermochemistry of Minerals.**  
Alexandra Navrotsky.

**CHAPTER 8. Thermodynamic Data from Crystal Field Spectra.**  
Roger G. Burns.

**CHAPTER 9. Comparative Crystal Chemistry and the Polyhedral Approach.**  
Robert M. Hazen.

**CHAPTER 10. Mineral Structure Energetics and Modeling Using the Ionic Approach.**  
Charles W. Burnham.

**CHAPTER 11. Thermodynamics of Phase Transitions.**  
Raymond Jeanloz.

This book should find its way onto the bookshelves of most research mineralogists and practitioners of mineral thermodynamics. It would provide the basis of a first-class graduate course placed to follow a graduate course in phase equilibrium and thermodynamics, and represents the only book with the specific aim of bridging between microscopic and macroscopic phenomena in the mineralogical sciences. In terms of value for its price, at \$13.00 U.S., it is an outstanding bargain. Most of the individual chapters are worth the price of the whole book.

**SUMMARY:** Highly recommended.

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