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# BOOK REVIEW

**High-Resolution Transmission Electron Microscopy and Associated Techniques.** Edited by PETER BUSECK, JOHN COWLEY, AND LEORY EYRING. Oxford Univ. Press, New York, 1988. xx + 645 pp. 67.00.

The high-resolution transmission electron microscope (HRTEM) has developed to the point where it should be considered a standard tool in solid state chemistry. Over the last 20 years, the point resolution on very thin specimens in the HRTEM has improved from about 5 Å to nearly 1.5 Å. An image of atomic columns along a prominent crystal zone in a very thin crystal has been given the name "structure image." This new level of image resolution often reveals atomic details that may be related to electrical, chemical, and mechanical properties. The present volume covers the principles and applications of this important analysis technique at the advanced undergraduate and graduate levels.

The first four chapters of the book cover electron imaging theory and elastic scattering in crystals. Each of these subjects is first presented in very readable descriptive terms followed by a discussion of the same material from a more mathematical viewpoint. This method of presentation should make imaging and diffraction theory accessible to a wide audience. In addition, a strong attempt is made to set forth standard nomenclature and sign conventions, a development that should interest all workers in the field.

Chapters 5 and 6 cover inelastic scattering primarily as it relates to electron energy loss spectroscopy (EELS) and to the interpretation of high-resolution images. Chapter 7 is a review of analysis techniques that are related to high-resolution electron microscopy such as EELS. The same extremely thin specimen required for HRTEM (<200 Å) may also be used for elemental and chemical analysis via the information-rich EELS technique. Chapter 8 discusses the calculation of structure images and diffraction patterns, particularly important for practical high-resolution imaging because only through the calculation of images can the investigator be sure that the interpretation of an experimental image is correct.

Chapters 9–11 describe recent applications of HRTEM to mineralogy, solid state chemistry, and materials science. The examples presented constitute a review of the knowledge gained from HRTEM in these fields over the last 10 years. The quality of the micrographs used in these examples is excellent. Chapter 12 is a discussion of practical aspects of attaining high-resolution images. Particularly useful are the discussions of contrast transfer functions and the use of optical diffraction patterns for microscope optimization.

Chapter 13 reviews electron microscopy of surfaces. This is one of the rare instances where the analysis of surfaces by transmission and reflection electron microscopy has been allotted an entire chapter in a textbook. The final chapter discusses imaging of noncrystalline materials.

Newcomers to the field should be aware that this book does not cover every TEM technique. For example, X-ray emission spectroscopy in the analytical electron microscope (AEM) is hardly mentioned at all. Also, it may not be clear to the casual reader that much of the work covered in this book can only be performed on very expensive specialized instruments. In terms of current electron microscope availability and usage, the moderate-resolution AEM, with X-ray emission spectroscopy and convergent beam electron diffraction as analytical tools, remains the most popular type of instrument for materials research. Some readers would benefit from references to recent books on the important topic of analytical electron microscopy.

This book is likely to become a classic in the subject area it covers, namely, high-resolution transmission electron microscopy. It is authoritative, readable, and clearly shows that HRTEM can provide a wealth of information about thin solid specimens that is difficult, if not impossible, to obtain by any other analytical method.

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