

Book Review for the Materials Research Bulletin

High-Energy Electron Diffraction and Microscopy

By: L.-M. Peng, S. L. Dudarev and M. J. Whelan

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Because of the strong electron-solid interaction, electron diffraction and microscopy based techniques can provide a wealth of information about materials with atomic resolution, but can be difficult to analyze due to multiple and inelastic scattering. A thorough understanding of the interaction of high-energy electrons with matter is therefore essential for any materials researcher who is interested in the quantitative interpretation of high-resolution electron micrographs or diffraction data. This book sets out to bridge the gap between elementary or application based texts and more obscure classical treatises, in order to leave the reader with a deeper understanding of the scattering process and to provide an insight into some more recent developments.

The early chapters introduce the basic concepts, such as kinematic diffraction theory, before they develop a description of dynamical diffraction, concentrating on Bloch wave methods. In later chapters, they then apply this methodology to both transmission and reflection geometries, with detailed consideration given to the effects of multiple, diffuse and inelastic scattering. This book also provides useful chapters on symmetry and perturbation methods and there is a brief chapter covering the effects of coherence and exit wave function retrieval. Finally tables of atomic scattering factors and Debye-Waller factors are included.

The notation used is clear and concise throughout. Some mathematical ability is expected of the reader, but the authors have been rigorous in explaining concepts from relatively simple principles. This is a fine book by three well respected authors, and is probably essential reading for anyone working in the area of electron microscope image simulation or quantitative interpretation.

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