

Preface

There is no doubt that imaging of nanometer-scaled materials (nano-imaging) is one of the important research areas in science and technology including bioscience. Among various kinds of experimental techniques, electron microscopy is positioned as one of the most effective methods for analyses of atomic structures, compositions, and physical and chemical properties.

The present volume is a textbook on nano-imaging by transmission electron microscopy (TEM) and scanning transmission electron microscopy (STEM) for graduate students and early career researchers. Although there are already many textbooks for TEM, the significance of the present publication is in describing the principle of nano-imaging and its application. For this purpose, I have limited my explanation of details of electron diffraction patterns and diffraction contrast of images, and let readers refer to appendices and other references. Instead of such details, I have made efforts to describe the physical meaning of imaging using electrons on the basis of Fourier transform, particularly electrons as waves.

This book starts with the physical nature of waves and extends to its application of imaging of atoms and crystalline lattices using electron waves. A number of appendices and footnotes are incorporated in order to include advanced knowledge of TEM and STEM for Ph.D. students and career researchers. They guide them to further study of related publications.

This book was preceded by *Nano-imaging by Electrons*, written in Japanese and published by Uchida-Rohkakuho (2009, Tokyo), but it is not a simple translation into English. I have reconsidered carefully the contents and order of chapters and added new information from scientific papers.

I am grateful to the many preceding researchers and for their papers on transmission electron microscopy and diffraction, and to those individuals who cooperated with me. Indeed, I am greatly indebted to the late professors R. Uyeda, N. Kato, K. Mihama, and J.M. Cowley for encouraging and leading me in the research field of electron diffraction and microscopy. Drs. Y. Oshima, K. Suenaga, K. Kimoto and H. Kurata are particularly acknowledged for providing me with useful information for preparing the manuscript of this book.

Mr. M. Uchida, the publisher of the preceding textbook in Japanese, is acknowledged for his generosity for use of most parts of the contents. Ms. M. Miwa and K. Nishibu, the author's secretaries, are also thanked for their help in typing and drawing.

Finally, I appreciate the kindness and understanding of my family members over a long period of time.

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