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Cambridge University Press
978-0-521-55490-9 - Characterization of High Tc Materials and Devices by Electron Microscopy
Edited by Nigel D. Browning and Stephen J. Pennycook
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CHARACTERIZATION OF HIGH T_c MATERIALS AND DEVICES BY ELECTRON MICROSCOPY

This is is a clear and up-to-date account of the application of electron-based microscopies to the study of high T_c superconductors.

Written by leading experts, this compilation provides a comprehensive review of scanning electron microscopy, transmission electron microscopy and scanning transmission electron microscopy together with details of each technique and its applications. Introductory chapters cover the basics of high-resolution transmission electron microscopy, including a chapter devoted to specimen preparation techniques, and microanalysis by scanning transmission electron microscopy. Ensuing chapters examine identification of new superconducting compounds, imaging of superconducting properties by low-temperature scanning electron microscopy, imaging of vortices by electron holography and electronic structure determination by electron energy loss spectroscopy. The use of scanning tunneling microscopy for exploring surface morphology, growth processes and the mapping of superconducting carrier distributions is discussed. Final chapters consider applications of electron microscopy to the analysis of grain boundaries, thin films and device structures. Detailed references are included.

This text will be an indispensable reference for graduate students and researchers in materials science, physics and engineering.

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Edited by

NIGEL D. BROWNING
University of Illinois at Chicago

STEPHEN J. PENNYCOOK
Oak Ridge National Laboratory, Tennessee

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Contributors

Lawrence M. Brown
University of Cambridge, Cavendish Laboratory, Madingley Road, Cambridge CB3 0HE, UK

Nigel D. Browning
Department of Physics, University of Illinois at Chicago, 845 West Taylor Street, Chicago, IL 60607-7059, USA

Matthew F. Chisholm
Solid State Division, Oak Ridge National Laboratory, 1 Bethel Valley Rd, Oak Ridge, TN 37831-6030, USA

Vinayak P. Dravid
Department of Materials Science & Engineering, Northwestern University, 2225 N. Campus Drive, Evanston, IL 60208, USA

Yufei Gao
Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439, USA. Present address: Interfacial and Processing Sciences, Pacific Northwest National Laboratory, 3335 Q Ave, MS K8-93, Richland, WA 99352, USA

Marilyn E. Hawley
Center for Materials Science, Los Alamos National Laboratory, MS K-765, Los Alamos, NM 87545, USA

Lianlong He
National Institute for Research on Inorganic Materials, Namiki 1-1, Tsukuba, Ibaraki 305, Japan

Shigeo Horiuchi
National Institute for Research on Inorganic Materials, Namiki 1-1, Tsukuba, Ibaraki 305, Japan

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Rudolph P. Huebener
Physikalisches Institut, Lehrstruhl Experimentalphysik II, Universität Tübingen, W-7400 Tübingen, Germany

Chunlin L. Jia
Institut für Festkörperforschung, Forschungszentrum Jülich GmbH, D-52425 Jülich, Germany

Thomas Krekels
University of Antwerp, RUCA, Groenenborgerlaan 171, B-2020 Antwerp, Belgium

Ann F. Marshall
Center for Materials Research, McCullough Building, Stanford University, Stanford, CA 94305-4045, USA

Karl L. Merkle
Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439, USA

Eva Olsson
Department of Physics, Chalmers University of Technology, S-412 96 Göteborg, Sweden. Present address: The Ångström Laboratory, Uppsala University, Box 534, Uppsala, SE-751 21, Sweden

Stephen J. Pennycook
Solid State Division, Oak Ridge National Laboratory, 1 Bethel Valley Rd, Oak Ridge TN 37831-6030, USA

Akira Tonomura
Advanced Research Laboratory, Hitachi Ltd, Hatoyama, Saitama 350-03, Japan

Knut Urban
Institut für Festkörperforschung, Forschungszentrum Jülich GmbH, D-52425, Jülich, Germany

Gustaaf Van Tendeloo
University of Antwerp, RUCA, Groenenborgerlaan 171, B-2020 Antwerp, Belgium

Boris V. Vuchic
Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL 60439, USA

Yun-Yu Wang
Northwestern University, Department of MS & E, 2225 Sheridan Road, 3013A MLSF, Evanston, IL 60208, USA

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Jian-Guo Wen
Superconductivity Research Laboratory, International Superconductivity Technology Center, 1-10-13 Shinonome, Koto-ku, Tokyo 135-0062, Japan

Jun Yuan
University of Cambridge, Cavendish Laboratory, Madingley Road, Cambridge CB3 0HE, UK

Yimei Zhu
Department of Applied Science, Brookhaven National Laboratory, Upton, Long Island, NY 11973, USA

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Preface

Discovered just over a hundred years ago, the ubiquitous electron now forms the basis for a remarkably large range of characterization tools. Surface roughness and morphology, local atomic and electronic structure, vortex motion and superconducting properties can all be imaged thanks to the electron. Being light in mass, samples withstand appreciable irradiation without destruction. Carrying a charge, electrons can be accelerated to high energies and focussed to form transmission images or fine probes, which enables the interior of bulk samples or thin films to be investigated. Electrons may be scattered elastically to provide images of defects and interfaces at atomic resolution, or inelastically, facilitating spectroscopic studies of electronic structure in the vicinity of individual defects or interfaces. Low energy electrons, guided by a metal probe, form the basis for scanning tunneling microscopy, revealing insights into the atomic and electronic structure of surfaces.

This book presents the entire range of electron-based microscopies as applied to high T_c superconductors, scanning electron microscopy, transmission electron microscopy and scanning tunneling microscopy. Introductory chapters cover the basics of high-resolution transmission electron microscopy and microanalysis by scanning transmission electron microscopy. One chapter deals in detail with the difficult procedures of specimen preparation. Other chapters deal with imaging techniques specific to superconductors, the imaging of vortices by electron holography and the mapping of weak links by low temperature scanning electron microscopy. Several chapters deal with specific applications to subjects such as grain boundaries, thin films and device structures. We hope that by covering the techniques from an introductory level to a detailed description of specific methods, from an applications perspective as well as fundamental research interests, that this book will be of value to all groups involved in high T_c superconductivity.

Grateful thanks are due to all contributors for their patience during the production of this book, and especially to Sharon Jesson for final editing.

NDB and SJP

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