

Handbook of Instrumentation and Techniques for Semiconductor Nanostructure Characterization

edited by

Richard Haight

IBM TJ Watson Research Center, USA

Frances M Ross

IBM TJ Watson Research Center, USA

James B Hannon

IBM TJ Watson Research Center, USA

Highlights:

- **First comprehensive handbook** on instrumentation and techniques for semiconductor nanostructure characterization
- **More than 900 references** providing up-to-date information
- **With over 260 illustrations**

In 2 Volumes

With Foreword by **Leonard C. Feldman**

Director Institute for Advanced Materials, Devices and Nanotechnology, Rutgers University, USA

As we delve more deeply into the physics and chemistry of functional materials and processes, we are inexorably driven to the nanoscale. And nowhere is the development of instrumentation and associated techniques more important to scientific progress than in the area of nanoscience. The dramatic expansion of efforts to peer into nanoscale materials and processes has made it critical to capture and summarize the cutting-edge instrumentation and techniques that have become indispensable for scientific investigation in this arena. This Handbook is a key resource developed for scientists, engineers and advanced graduate students in which eminent scientists present the forefront of instrumentation and techniques for the study of structural, optical and electronic properties of semiconductor nanostructures.

Readership: Advanced graduate students and professionals in physics, chemistry, materials science and nanoscience.

1050pp

978-981-4322-80-5

Aug 2011

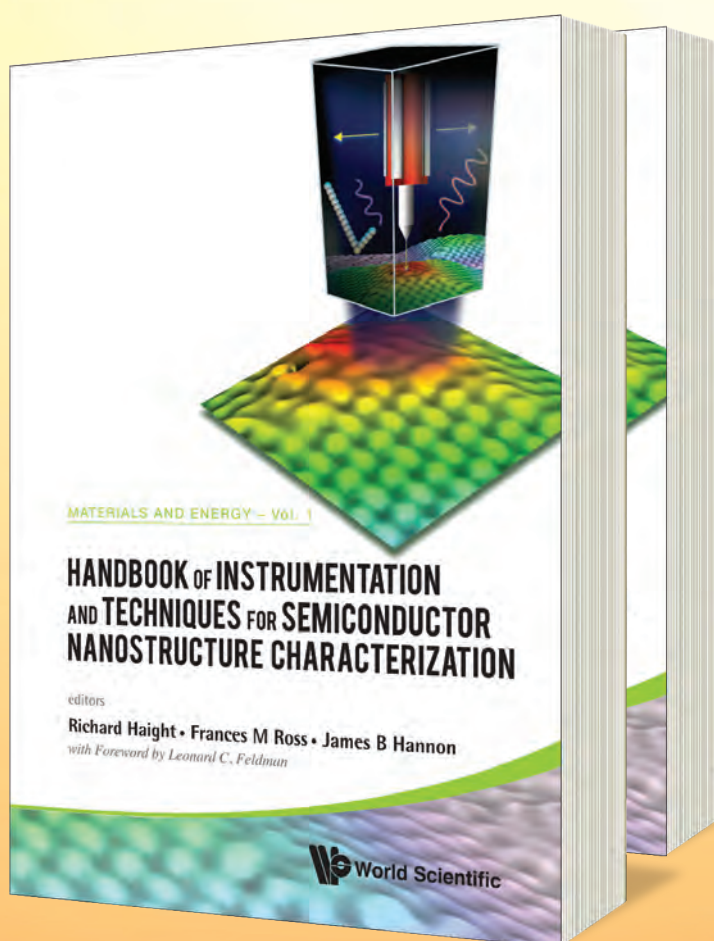
~~US\$480~~ ~~£298~~

US\$420 £260

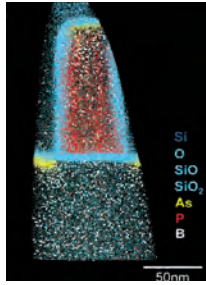
(Introductory Offer till Jan 31, 2012)

978-981-4322-84-3(ebook)

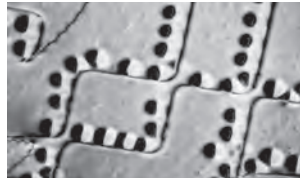
US\$624



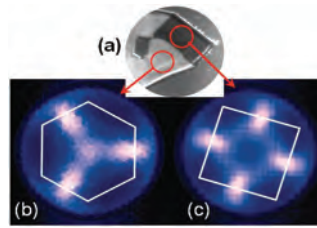
Samples of the 260 Illustrations



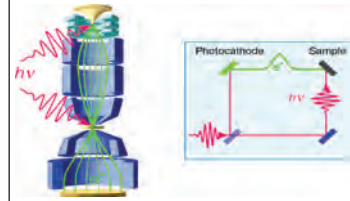
Atom probe tomograph map of an n-doped MOSFET including gate, gate oxide, channel, source/drain extension, and halo implant.



Nanoscale Ge islands grown on a dislocated Si/SiGe heterostructure substrate. Because of strain induced on the surface by the buried dislocations, the islands (dark semicircles) grow above the dislocations (dark lines).



Low Energy Electron Microscope image of polycrystalline Ag with spatially resolved band structure mapping showing the three-fold Ag(111) and four-fold symmetric Ag(100) regions.



A schematic illustration of a laser-pump electron-probe instrument designed to measure ultrafast dynamics in a nanostructured material.

Contents:

VOLUME 1

ELECTRON MICROSCOPIES

- Characterization of Semiconductor Nanostructures by Scanning Electron Microscopy
Lynne M. Gignac and Oliver C. Wells
(*IBM TJ Watson Research Center, USA*)
- Transmission Electron Microscopy and Ultrahigh Vacuum Transmission Electron Microscopy of Semiconductor Nanostructures
Suneel Kodambaka (*University of California Los Angeles, USA*),
Frances Ross (*IBM TJ Watson Research Center, USA*)
- Aberration Corrected Electron Microscopy
Philip E. Batson (*Rutgers University, USA*)
- Low Energy Electron Microscopy for Nanoscale Characterization
James B. Hannon and Rudolf M. Tromp
(*IBM TJ Watson Research Center, USA*)
- Ultrafast Microscopy of Plasmon Dynamics in Nanostructured Metal Surfaces
Hrvoje Petek (*University of Pittsburgh, USA*) and Atsushi Kubo
(*University of Tsukuba, Japan*)

X-RAY DIFFRACTION TECHNIQUES

- X-ray Diffraction Methods for Studying Strain and Composition in Epitaxial Nanostructured Systems
A. Malachias (*Laboratório Nacional de Luz Síncrotron, Brazil*),
R. Freitas and S. Morelhaio (*Universidade de São Paulo, Brazil*),
R. Magalhaes-Paniago (*Universidade Federal de Minas Gerais, Brazil*),
S. Kyria (*University of Guelph, Guelph, Canada*) and G. Medeiros-Ribiero

(*Hewlett-Packard Laboratories, USA*)

- Stress Determination in Semiconductor Nanostructures using X-ray Diffraction
Conal E. Murry (*IBM TJ Watson Research Center, USA*) and I.C. Noyan
(*Columbia University, USA*)

VOLUME 2

SCANNING PROBES

- An Introduction to Scanning Probe Microscopy of Semiconductors with Case Studies Concerning Gallium Nitride and Related Materials
Rachel Oliver (*University of Cambridge, UK*)
- STM of Self Assembled III-V Nanostructures
V. D. Dasika and Rachel Goldman (*University of Michigan, USA*)

ATOM AND OPTICAL PROBES

- Atom Probe Tomography for Microelectronics
David J. Larson, Ty J. Prosa, Dan Lawrence, Brian P. Geiser, Clive M. Jones, Thomas F. Kelly (*Cameca Instruments Inc., USA*)
- Raman Spectroscopy of Carbon Nanotubes and Graphene Materials and Devices
Marcus Freitag and James C. Tsang
(*IBM TJ Watson Research Center, USA*)
- Single Nanowire Photoelectron Spectroscopy
Carlos Aguilar (*MIT Lincoln Laboratory, USA*) and Richard Haight (*IBM TJ Watson Research Center, USA*)
- Time-Domain Thermoreflectance Measurements for Thermal Property Characterization of Nanostructures
Scott Huxtable (*Virginia Tech, USA*)

Cambridge University Press India Pvt. Ltd.

Cambridge House,
4381/4, Ansari Road,
Daryaganj, New Delhi – 110002
Tel : + 91 11 43543500
Fax : + 91 11 23288534
Email : cupdel@cambridge.org

Cambridge University Press India Pvt. Ltd.

C-22, Brigade M.M.,
K.R. Road, Jayanagar,
Bengaluru – 560070
Tel : + 91 80 26764817, 26762764, 65593388
Fax : + 91 80 26761322
Email : cupbang@cambridge.org

Cambridge University Press India Pvt. Ltd.

The Cambridge Centre,
21/1 (New No. 49), 1st Floor,
Model School Road, Thousand Lights
Chennai – 600006
Tel : + 91 44 42146807, 28291294
Fax : + 91 44 28291295
Email : cupchen@cambridge.org

Printed in September 2011

Cambridge University Press India Pvt. Ltd.

The Cambridge Centre
10, Raja Subodh Mullick Square
2nd Floor
Kolkata - 700013
Tel : + 91 33 22259976, 22250046
Fax : + 91 33 22250327
Email : cupkol@cambridge.org

Cambridge University Press India Pvt. Ltd.

Cambridge House,
Plot No. 80, Service Industries,
Shirvane, Sector – 1, Nerul,
Navi Mumbai – 400706
Tel : + 91 22 27709172, 27713810
Fax : + 91 22 27709173
Email : cupmum@cambridge.org

Cambridge University Press India Pvt. Ltd.

House No.3-5-874/6/4 (Near Apollo Hospital),
Hyderguda, Hyderabad - 500 029
Tel : + 91 40 23244458, 66101126
Fax : + 91 40 23244459
E-mail : cuphyd@cambridge.org

Cambridge University Press India Pvt. Ltd.

Agarwal Pride, A Wing
1308, Kasba Peth
Near Surya Hospital
Pune – 411011
Tel : +91 20 24575767, 24575768
Fax : +91 20 24575768
Email : cuppune@cambridge.org

Cambridge University Press India Pvt. Ltd.

T.C. 25/2731
Lukes Lane, Ambujavilasam Road,
Thiruvananthapuram 695 001
Phone: +91 471 406 4404, 406 4405
Fax : +91 471 4070093
Email : cupptvm@cambridge.org

Cambridge University Press India Pvt. Ltd.

Monzeera House, Om Bhawan
2nd Floor, Panbazar
Guwahati - 781001
Tel : (91) 361 2735336
Email : nkaoty@cambridge.org