In-situ Electron Microscopy. Applications in Physics, Chemistry and Materials Science

Description: Adopting a didactical approach from fundamentals to actual experiments and applications, this handbook and ready reference covers real–time observations using modern scanning electron microscopy and transmission electron microscopy, while also providing information on the required stages and samples. The text begins with introductory material and the basics, before describing advancements and applications in dynamic transmission electron microscopy and reflection electron microscopy. Subsequently, the techniques needed to determine growth processes, chemical reactions and oxidation, irradiation effects, mechanical, magnetic, and ferroelectric properties as well as cathodoluminiscence and electromigration are discussed.

Contents: (short)
Basics
Thermodynamics
Mechanical Properties
Magnetic Properties
Optical Properties
Electronic Properties
Ferroelectric Properties
Soft Matter

(long)
I. Basics
Scanning Electron Microscopy (SEM)
Focused Ion Beam Microscopy (FIB)
Transmission Electron Microscopy (including HRTEM and STEM)
Camera Systems for Dynamic TEM Experiments
II. Thermodynamics
Growth Processes
Melting and Pre-melting
Chemical Reactions and Oxidation
Interface Kinetics
Formation of Silicides from a-Si and metal layers
Formation of Surface Patterns observed by Reflection Electron Microscopy

III. Mechanical Properties

The FIB Platform

Mechanical Tests in the SEM

Strain Mapping by Image Correlation (SEM to HRTEM)

Dislocation Mechanisms

New Developments: In-situ Nanoindentation, AFM, and STM Experiments in the TEM

IV. Magnetic Properties

Lorentz-Microscopy

Dynamic Observations of Domains, Vortices and of Ultrafast Phenomena by TEM and PEEM

V. Optical Properties

Cathodoluminiscence in SEM and TEM

Optical Properties of Nanotubes

VI. Electronic Properties

EBIC (SEM) and Potential Contrast

Electromigration (SEM, TEM)

VII. Ferroelectric Properties

Ferroelectric Domains

VIII. Soft Matter

Experiments using Wet-cells (SEM, ESEM, biological samples and materials)

Structure Determination of Soft Matter using In-situ Techniques

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