

Rolf Erni



Aberration-Corrected Imaging in Transmission Electron Microscopy

An Introduction
2nd Edition

Imperial College Press

Aberration Corrected Imaging In Transmission Electron Microscopy

**Sathish-Kumar Kamaraj,Arun
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Aberration Corrected Imaging In Transmission Electron Microscopy:

Aberration-corrected Imaging In Transmission Electron Microscopy: An Introduction (2nd Edition) Rolf Erni,2015-03-23

Aberration Corrected Imaging in Transmission Electron Microscopy provides an introduction to aberration corrected atomic resolution electron microscopy imaging in materials and physical sciences It covers both the broad beam transmission mode TEM transmission electron microscopy and the scanning transmission mode STEM scanning transmission electron microscopy The book is structured in three parts The first part introduces the basics of conventional atomic resolution electron microscopy imaging in TEM and STEM modes This part also describes limits of conventional electron microscopes and possible artefacts which are caused by the intrinsic lens aberrations that are unavoidable in such instruments The second part introduces fundamental electron optical concepts and thus provides a brief introduction to electron optics Based on the first and second parts of the book the third part focuses on aberration correction it describes the various aberrations in electron microscopy and introduces the concepts of spherical aberration correctors and advanced aberration correctors including correctors for chromatic aberration This part also provides guidelines on how to optimize the imaging conditions for atomic resolution STEM and TEM imaging This second edition has been completely revised and updated in order to incorporate the very recent technological and scientific achievements that have been realized since the first edition appeared in 2010

Aberration-corrected Imaging in Transmission Electron Microscopy Rolf Erni,2015 Aberration-Corrected Imaging in Transmission Electron Microscopy Rolf Erni,2010

Aberration-corrected Imaging in Transmission Electron Microscopy Rolf Erni,2015 This book provides an introduction to aberration corrected atomic resolution electron microscopy imaging in materials and physical sciences It covers both the broad beam transmission mode TEM transmission electron microscopy and the scanning transmission mode STEM scanning transmission electron microscopy

Aberration-Corrected Analytical Transmission Electron Microscopy Rik Brydson,2011-08-02 The book is concerned with the theory background and practical use of transmission electron microscopes with lens correctors that can correct the effects of spherical aberration The book also covers a comparison with aberration correction in the TEM and applications of analytical aberration corrected STEM in materials science and biology This book is essential for microscopists involved in nanoscale and materials microanalysis especially those using scanning transmission electron microscopy and related analytical techniques such as electron diffraction x ray spectrometry EDXS and electron energy loss spectroscopy EELS

Direct Imaging of Light Elements in Aberration-Corrected Scanning Transmission Electron Microscopy ,2009

Logarithmic Image Processing: Theory and Applications ,2016-07-26 Logarithmic Image Processing Theory and Applications the latest volume in the series that merges two long running serials Advances in Electronics and Electron Physics and Advances in Optical and Electron Microscopy and features cutting edge articles on recent developments in all areas of microscopy digital image processing and many related subjects in electron physics Merges two long running serials

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Analytical, Approximate-Analytical and Numerical Methods in the Design of Energy Analyzers, 2015-11-16 Advances in Imaging and Electron Physics merges two long running serials Advances in Electronics and Electron Physics and Advances in Optical and Electron Microscopy The series features extended articles on the physics of electron devices especially semiconductor devices particle optics at high and low energies microlithography image science and digital image processing electromagnetic wave propagation electron microscopy and the computing methods used in all these domains Contains contributions from leading authorities on the subject matter Informs and updates on all the latest developments in the field of imaging and electron physics Provides practitioners interested in microscopy optics image processing mathematical morphology electromagnetic fields electron and ion emission with a valuable resource Features extended articles on the physics of electron devices especially semiconductor devices particle optics at high and low energies microlithography image science and digital image processing

Nanoscale Ferroelectrics and Multiferroics Miguel Alguero, J. Marty

Gregg, Liliana Mitoseriu, 2016-05-31 Dieses Buch beleuchtet die wichtigsten Aspekte der Verarbeitung und Charakterisierung von Ferroelektrika und Multiferroika auf Nanoebene präsentiert eine umfassende Beschreibung der jeweiligen Eigenschaften und legt dabei den Schwerpunkt auf die Unterscheidung von Groneffekten bei extrinsischen Eigenschaften wie Rand oder Interface Effekte Eingegangen wird auch auf neuartige Nanoebene Das Fachbuch ist in drei Abschnitte unterteilt und beschreibt die Verarbeitung Nanostrukturierung Charakterisierung nanostrukturierter Materialien und Nanoeffekte Unter Rückgriff auf die Synergien zwischen Nano Ferroelektrika und Multiferroika werden Materialien behandelt die auf allen Ebenen einer Nanostrukturierung unterzogen werden von Technologien für keramische Materialien wie ferroelektrische Nanopulver nanostrukturierte Keramiken und Dickschichten sowie magnetoelektrische Nanokomposit Materialien bis hin zu freistehenden Nanoobjekten mit spezifischen Geometrien wie Nanodrähte und Nanoröhren auf verschiedenen Entwicklungsstufen Grundlage des Buches ist die europäische Wissensplattform im Wissenschaftsbereich innerhalb der Aktion von COST Europäische Zusammenarbeit in Wissenschaft und Technik zu einem und mehrphasigen Ferroika und Multiferroika mit begrenzten Geometrien SIMUFER Ref MP0904 Die Autoren der Kapitelbeiträge wurden sorgfältig ausgewählt haben allesamt ganz wesentlich zur Wissensbasis für das jeweilige Thema beigetragen und gehören vor allem zu den renommiertesten Wissenschaftlern des Fachgebiets

In-Situ Transmission Electron Microscopy Experiments Renu Sharma, 2023-05-10 In Situ Transmission Electron Microscopy Experiments Design and execute cutting edge experiments with transmission electron microscopy using this essential guide In situ microscopy is a recently discovered and rapidly developing approach to transmission electron microscopy TEM that allows for the study of atomic and or molecular changes

and processes while they are in progress Experimental specimens are subjected to stimuli that replicate near real world conditions and their effects are observed at a previously unprecedented scale Though in situ microscopy is becoming an increasingly important approach to TEM there are no current texts combining an up to date overview of this cutting edge set of techniques with the experience of in situ TEM professionals In Situ Transmission Electron Microscopy Experiments meets this need with a work that synthesizes the collective experience of myriad collaborators It constitutes a comprehensive guide for planning and performing in situ TEM measurements incorporating both fundamental principles and novel techniques Its combination of technical detail and practical how to advice makes it an indispensable introduction to this area of research In Situ Transmission Electron Microscopy Experiments readers will also find Coverage of the entire experimental process from method selection to experiment design to measurement and data analysis Detailed treatment of multimodal and correlative microscopy data processing and machine learning and more Discussion of future challenges and opportunities facing this field of research In Situ Transmission Electron Microscopy Experiments is essential for graduate students post doctoral fellows and early career researchers entering the field of in situ TEM

High-Resolution Electron Microscopy John C. H. Spence,2013-09-12 This new fourth edition of the standard text on atomic resolution transmission electron microscopy TEM retains previous material on the fundamentals of electron optics and aberration correction linear imaging theory including wave aberrations to fifth order with partial coherence and multiple scattering theory Also preserved are updated earlier sections on practical methods with detailed step by step accounts of the procedures needed to obtain the highest quality images of atoms and molecules using a modern TEM or STEM electron microscope Applications sections have been updated these include the semiconductor industry superconductor research solid state chemistry and nanoscience and metallurgy mineralogy condensed matter physics materials science and material on cryo electron microscopy for structural biology New or expanded sections have been added on electron holography aberration correction field emission guns imaging filters super resolution methods Ptychography Ronchigrams tomography image quantification and simulation radiation damage the measurement of electron optical parameters and detectors CCD cameras Image plates and direct injection solid state detectors The theory of Scanning transmission electron microscopy STEM and Z contrast are treated comprehensively Chapters are devoted to associated techniques such as energy loss spectroscopy Alchemi nanodiffraction environmental TEM twisty beams for magnetic imaging and cathodoluminescence Sources of software for image interpretation and electron optical design are given

Materials Characterization Using Nondestructive Evaluation (NDE) Methods Gerhard Huebschen,Iris Altpeter,Ralf Tschuncky,Hans-Georg Herrmann,2016-03-23 Materials Characterization Using Nondestructive Evaluation NDE Methods discusses NDT methods and how they are highly desirable for both long term monitoring and short term assessment of materials providing crucial early warning that the fatigue life of a material has elapsed thus helping to prevent service failures Materials Characterization Using Nondestructive Evaluation NDE Methods gives an overview of

established and new NDT techniques for the characterization of materials with a focus on materials used in the automotive aerospace power plants and infrastructure construction industries Each chapter focuses on a different NDT technique and indicates the potential of the method by selected examples of applications Methods covered include scanning and transmission electron microscopy X ray microtomography and diffraction ultrasonic electromagnetic microwave and hybrid techniques The authors review both the determination of microstructure properties including phase content and grain size and the determination of mechanical properties such as hardness toughness yield strength texture and residual stress Gives an overview of established and new NDT techniques including scanning and transmission electron microscopy X ray microtomography and diffraction ultrasonic electromagnetic microwave and hybrid techniques Reviews the determination of microstructural and mechanical properties Focuses on materials used in the automotive aerospace power plants and infrastructure construction industries Serves as a highly desirable resource for both long term monitoring and short term assessment of materials

Transmission Electron Microscopy Techniques Kaushal Dhawan,2025-02-20 Transmission Electron Microscopy Techniques is a comprehensive guide that explores the use of transmission electron microscopes TEM to study materials at the atomic level TEMs use electrons instead of light to magnify objects achieving resolutions millions of times greater than light microscopes We cover all aspects of TEM from the basic principles of how it works to the latest advancements in the field This book includes practical information on using a TEM and troubleshooting potential issues Complex concepts are explained clearly and simply making them accessible to those new to TEM The book features many diagrams micrographs and schematics to help visualize the discussed concepts We explore how TEM is used in various fields such as materials science biology and nanotechnology and discuss the latest advancements in TEM technology including aberration corrected microscopy and cryo TEM Practical guidance is provided on using a TEM and troubleshooting common problems Transmission Electron Microscopy Techniques is a valuable resource for students researchers and professionals interested in TEM and its applications

Scanning Transmission Electron Microscopy Alina Bruma,2020-12-22 Scanning Transmission Electron Microscopy Advanced Characterization Methods for Materials Science Applications The information comprised in this book is focused on discussing the latest approaches in the recording of high fidelity quantitative annular dark field ADF data It showcases the application of machine learning in electron microscopy and the latest advancements in image processing and data interpretation for materials notoriously difficult to analyze using scanning transmission electron microscopy STEM It also highlights strategies to record and interpret large electron diffraction datasets for the analysis of nanostructures This book Discusses existing approaches for experimental design in the recording of high fidelity quantitative ADF data Presents the most common types of scintillator photomultiplier ADF detectors along with their strengths and weaknesses Proposes strategies to minimize the introduction of errors from these detectors and avenues for dealing with residual errors Discusses the practice of reliable multiframe imaging along with the benefits and new experimental

opportunities it presents in electron dose or dose rate management Focuses on supervised and unsupervised machine learning for electron microscopy Discusses open data formats community driven software and data repositories Proposes methods to process information at both global and local scales and discusses avenues to improve the storage transfer analysis and interpretation of multidimensional datasets Provides the spectrum of possibilities to study materials at the resolution limit by means of new developments in instrumentation Recommends methods for quantitative structural characterization of sensitive nanomaterials using electron diffraction techniques and describes strategies to collect electron diffraction patterns for such materials This book helps academics researchers and industry professionals in materials science chemistry physics and related fields to understand and apply computer science derived analysis methods to solve problems regarding data analysis and interpretation of materials properties

Advanced Computing in Electron Microscopy Earl J. Kirkland,2020-03-09

This updated and revised edition of a classic work provides a summary of methods for numerical computation of high resolution conventional and scanning transmission electron microscope images At the limits of resolution image artifacts due to the instrument and the specimen interaction can complicate image interpretation Image calculations can help the user to interpret and understand high resolution information in recorded electron micrographs The book contains expanded sections on aberration correction including a detailed discussion of higher order multipole aberrations and their effect on high resolution imaging new imaging modes such as ABF annular bright field and the latest developments in parallel processing using GPUs graphic processing units as well as updated references Beginning and experienced users at the advanced undergraduate or graduate level will find the book to be a unique and essential guide to the theory and methods of computation in electron microscopy

Springer Handbook of Microscopy Peter W. Hawkes,John C.H. Spence,2019-11-02

This book features reviews by leading experts on the methods and applications of modern forms of microscopy The recent awards of Nobel Prizes awarded for super resolution optical microscopy and cryo electron microscopy have demonstrated the rich scientific opportunities for research in novel microscopies Earlier Nobel Prizes for electron microscopy the instrument itself and applications to biology scanning probe microscopy and holography are a reminder of the central role of microscopy in modern science from the study of nanostructures in materials science physics and chemistry to structural biology Separate chapters are devoted to confocal fluorescent and related novel optical microscopies coherent diffractive imaging scanning probe microscopy transmission electron microscopy in all its modes from aberration corrected and analytical to *in situ* and time resolved low energy electron microscopy photoelectron microscopy cryo electron microscopy in biology and also ion microscopy In addition to serving as an essential reference for researchers and teachers in the fields such as materials science condensed matter physics solid state chemistry structural biology and the molecular sciences generally the Springer Handbook of Microscopy is a unified coherent and pedagogically attractive text for advanced students who need an authoritative yet accessible guide to the science and practice of microscopy

Microscopic

Techniques for the Non-Expert Sathish-Kumar Kamaraj, Arun Thirumurugan, Shanmuga Sundar Dhanabalan, Samuel A. Hevia, 2022-06-27 This book covers fundamental microscopic techniques for Scanning Electron Microscopy SEM Transmission Electron Microscopy TEM Atomic Force Microscopy AFM and other microscopic tools It provides step by step instructions and explanations of the basic fundamental concepts and mechanisms and guides the reader on resolving queries related to taking and analyzing microscopy images The latest advancements and developments in microscopic equipment are described Theoretical background on microscopy is also provided to enhance the reader's understanding of microscopy techniques and tools Microscopic Techniques for the Non Expert is an ideal book for undergraduate and postgraduate students as well as researchers with a background in environmental science materials science biomedicine engineering or bio nanotechnology **Multiferroics** Andres Cano, Dennis Meier, Morgan Trassin, 2021-06-21 Multiferroic materials with a coexistence of magnetic and ferroelectric order provide an efficient route for the control of magnetism by electric fields The authors cover multiferroic thin film heterostructures device architectures and domain interface effects They critically discuss achievements as well as limitations and assess opportunities for future applications Springer Handbook of Semiconductor Devices Massimo Rudan, Rossella Brunetti, Susanna Reggiani, 2022-11-10 This Springer Handbook comprehensively covers the topic of semiconductor devices embracing all aspects from theoretical background to fabrication modeling and applications Nearly 100 leading scientists from industry and academia were selected to write the handbook's chapters which were conceived for professionals and practitioners material scientists physicists and electrical engineers working at universities industrial R&D and manufacturers Starting from the description of the relevant technological aspects and fabrication steps the handbook proceeds with a section fully devoted to the main conventional semiconductor devices like e.g. bipolar transistors and MOS capacitors and transistors used in the production of the standard integrated circuits and the corresponding physical models In the subsequent chapters the scaling issues of the semiconductor device technology are addressed followed by the description of novel concept based semiconductor devices The last section illustrates the numerical simulation methods ranging from the fabrication processes to the device performances Each chapter is self-contained and refers to related topics treated in other chapters when necessary so that the reader interested in a specific subject can easily identify a personal reading path through the vast contents of the handbook **Principles of Electron Optics, Volume 1** Peter W. Hawkes, Erwin Kasper, 2017-10-29 Volume one of Principles of Electron Optics Basic Geometrical Optics Second Edition explores the geometrical optics needed to analyze an extremely wide range of instruments cathode ray tubes the family of electron microscopes including the fixed beam and scanning transmission instruments the scanning electron microscope and the emission microscope electron spectrometers and mass spectrograph image converters electron interferometers and diffraction devices electron welding machines and electron beam lithography devices The book provides a self-contained detailed modern account of electron optics for anyone involved with particle beams of modest current

density in the energy range up to a few mega electronvolts You will find all the basic equations with their derivations recent ideas concerning aberration studies extensive discussion of the numerical methods needed to calculate the properties of specific systems and guidance to the literature of all the topics covered A continuation of these topics can be found in volume two Principles of Electron Optics Applied Geometrical Optics The book is intended for postgraduate students and teachers in physics and electron optics as well as researchers and scientists in academia and industry working in the field of electron optics electron and ion microscopy and nanolithography Offers a fully revised and expanded new edition based on the latest research developments in electron optics Written by the top experts in the field Covers every significant advance in electron optics since the subject originated Contains exceptionally complete and carefully selected references and notes Serves both as a reference and text

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