

1. Record Nr.	UNINA9910993973903321
Titolo	The X-ray standing wave technique : principles and applications // editors, Jorg Zegenhagen, Alexander Kazimirov
Pubbl/distr/stampa	Singapore ; ; Hackensack, NJ, : World Scientific, c2013 New Jersey : , : World Scientific, , [2013] 2013
ISBN	9789812279007 9781299462144 1299462146 9789812779014 9812779019 9789812779007
Edizione	[1st ed.]
Descrizione fisica	1 online resource (557 pages)
Collana	Series on synchrotron radiation techniques & applications ; ; v. 7
Altri autori (Persone)	ZegenhagenJorg KazimirovAlexander
Disciplina	530.141
Soggetti	Electromagnetic waves Standing waves
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- CONTENTS -- Dedication -- Preface -- Acronyms -- Part I -- 1. X-Ray Standing Waves in a Nutshell Jorg Zegenhagen and Alexander Kazimirov -- 1.1 Introduction -- 1.2 Historical Background -- 1.3 The Basic Principle of the XSW Technique -- 1.4 How to Create a Suitable XSW -- 1.5 X-Ray Scattering -- 1.6 Photo-Excitation and Dipole Approximation -- 1.7 Photo-Excitation and Decay Channels: Which Signal to Detect -- 1.8 Structural Analysis with XSW: Photo-Absorption, XSW Yield, and Fourier Analysis -- 1.9 Simple Structural Analysis in Case of an XSW Excited by Bragg Reflection -- 1.10 XSW Yield from the Bulk -- 1.11 Preview -- References -- 2. Dynamical Theory of X-ray Standing Waves in Perfect Crystals Andre Authier -- 2.1 Introduction -- 2.2 Diffracted Waves in the Reflection and Transmission Geometries -- 2.2.1 Propagation equation -- 2.2.2 Fundamental equations of

dynamical theory -- 2.2.3 Dispersion surface in the infinite medium --
 2.2.3.1 Non-absorbing crystals -- 2.2.3.2 Absorbing crystals -- 2.2.4
 Determination of the tiepoints -- 2.2.5 Deviation parameter -- 2.2.6
 Amplitudes of the diffracted waves -- 2.2.6.1 Bragg or reflection
 geometry -- 2.2.6.2 Laue or transmission geometry -- 2.3 Standing
 Wave Field in the Reflection (Bragg) Geometry -- 2.4 Standing Wave
 Field in the Transmission (Laue) Geometry -- 2.5 Applications of X-ray
 Standing Waves in the Laue Geometry -- 2.5.1 Introduction -- 2.5.2
 Integrated yield -- 2.5.3 Angular dependence of the X-ray fluorescence
 integrated yield -- References -- 3. X-Ray Standing Wave in Complex
 Crystal Structures Victor Kohn -- 3.1 Introduction -- 3.2 Solution for
 One Crystal Layer -- 3.2.1 Local reflection amplitude -- 3.2.2 Local
 transmission amplitude -- 3.3 Secondary Radiation Yield -- 3.4 Method
 of the Computer Simulation -- 3.4.1 Example: InGaP/GaAs(111).
 3.5 Brief Historical Overview and Summary -- References -- 4. X-Ray
 Standing Wave in a Backscattering Geometry D. P. Woodruff --
 References -- 5. X-Ray Standing Wave at the Total Reflection Condition
 Michael J. Bedzyk -- 5.1 Introduction -- 5.2 X-Ray Transmission and
 Reflection at a Single Interface -- 5.3 The E-Field Intensity -- 5.4 X-
 Ray Fluorescence Yield from an Atomic Layer within a Thin Film -- 5.5
 Fourier Inversion for a Direct Determination of (z) -- 5.6 The Effect of
 Coherence on X-Ray Interference Fringe Visibility -- Acknowledgments
 -- References -- 6. X-Ray Standing Wave at Grazing Incidence and Exit
 Osami Sakata and Terrence Jach -- 6.1 Introduction -- 6.2 Geometry,
 Waves, and Dispersion Surface -- 6.3 The Standing Wave Field Above a
 Surface -- 6.4 Applications -- References -- 7. X-Ray Standing Wave in
 Multilayers Michael J. Bedzyk and Joseph A. Libera -- 7.1 Introduction
 -- 7.2 Calculating the X-Ray Fields within a Multilayer Structure -- 7.3
 Analysis of the XRF Yield -- Acknowledgments -- References -- 8.
 Kinematical X-ray Standing Waves Martin Tolkiehn and Dmitri V.
 Novikov -- 8.1 Introduction -- 8.2 Theory -- 8.3 Application of KXSW
 to Mosaic Cu₃Au -- 8.4 Conclusions -- Acknowledgments --
 References -- 9. X-ray Waveguides Ianna Bukreev, Alessia Cedola,
 Daniele Pellicia, Werner Jark and Stefano Lagomarsino -- 9.1
 Introduction -- 9.2 X-Ray WG Basic Principles -- 9.2.1 Resonant beam
 coupling -- 9.2.2 Front coupling with pre-reflection -- 9.2.3 Direct
 front coupling -- 9.2.4 Comparison of RBC and FC WGs -- 9.3 X-Ray
 WG Fabrication Procedures -- 9.4 Application of X-Ray WGs -- 9.5
 Conclusions -- Acknowledgments -- References -- 10. Compton
 Scattering from X-Ray Standing Wave Field Vladimir Bushuev -- 10.1
 Introduction: Incoherent Compton Scattering -- 10.2 Coherent
 Compton Effect in the Bragg Geometry.
 10.3 Coherent Compton Effect and Electron Density Distribution --
 10.4 Coherent Compton Effect in the Laue Geometry --
 Acknowledgments -- References -- 11. Theory of Photoelectron
 Emission from an X-Ray Interference Field Ivan A. Vartanyants and Jorg
 Zegenhagen -- 11.1 Introduction -- 11.2 Photoelectron Scattering
 Process by a Single Electromagnetic Wave -- 11.2.1 Non-dipole
 contributions -- 11.3 Generalized Expression for the Photoelectron
 Yield from Atoms within the XSW -- 11.4 Matrix Elements for Multipole
 Terms: General Expression -- 11.5 Integral Photoelectron Emission
 from an Interference Field -- 11.6 Angular-Resolved Photoelectron
 Emission in the Dipole Approximation -- 11.7 Angular-Resolved
 Photoelectron Emission in the Dipole-Quadrupole Approximation --
 11.7.1 s-initial state -- 11.7.2 p-initial state -- 11.8 Theory of
 Valence-Electron Emission by an X-Ray Standing Wave -- 11.9
 Summary -- References -- 12. Site-Specific X-Ray Photoelectron
 Spectroscopy using X-Ray Standing Waves Joseph C. Woicik -- 12.1

Introduction -- 12.2 XSW Emission of Valence Electrons: The Dipole Approximation and the Case of Crystalline Copper -- 12.3 XSW Analysis of Valence Electron Emission for Homopolar and Heteropolar Crystals: Valence-Charge Asymmetry and the Cases of Crystalline Ge and GaAs -- 12.4 High-Resolution XSW Analysis of the GaAs Valence Band: Experimental Determination of Photoelectron Partial Density of States -- 12.5 Conclusion -- Acknowledgments -- References -- 13. Experimental Basics Alexander Kazimirov and Jorg Zegenhagen -- 13.1 Introduction -- 13.2 X-Ray Sources -- 13.2.1 X-ray tubes -- 13.3 Synchrotron Radiation -- 13.3.1 Introduction -- 13.3.2 Properties of synchrotron radiation -- 13.4 Beam Conditioning -- 13.4.1 DuMond diagram -- 13.4.2 Laboratory XSW optical set-up -- 13.4.3 XSW set-up at a synchrotron source. 13.5 Detection of Secondary Radiation -- 13.5.1 Detection of fluorescence radiation -- 13.5.1.1 Introduction -- 13.5.1.2 Semiconductor detector -- 13.5.2 Detection of electrons -- 13.5.2.1 Introduction -- 13.5.2.2 Electron multipliers -- 13.5.2.3 Gas proportional counter -- 13.5.2.4 Electrostatic electron analyzers -- 13.6 Data Acquisition and Preliminary Analysis -- 13.7 The Beamline ID32 at the ESRF: A Dedicated XSW Station -- 13.8 Summary -- References -- Part II -- Introduction to Part 2 -- 14. XSW Imaging Michael J. Bedzyk and Paul Fenter -- 14.1 Introduction -- 14.2 1D Profiling of Lattice Impurity Sites -- 14.3 3D Map of Surface Adsorbate Atoms -- 14.4 Experimental Description -- 14.5 Conclusion -- Acknowledgments -- References -- 15. X-Ray Standing Waves in Quasicrystals: Atomic Positions in an Aperiodic Lattice Terrence Jach -- 15.1 Introduction -- 15.2 One-Dimensional Quasi-Lattices -- 15.3 Dynamical Diffraction from 1D Quasi-Lattices -- 15.4 Centrosymmetry versus Non-Centrosymmetry -- 15.5 Quasicrystals in Three Dimensions -- 15.6 X-Ray Standing Wave Measurements -- 15.7 Conclusions and Remarks -- References -- 16. X-Ray Standing Waves in Thin Crystals: Probing the Polarity of Thin Epitaxial Films Alexander Kazimirov, Jorg Zegenhagen, Tien-Lin and Michael Bedzyk -- 16.1 Introduction -- 16.2 GaN Thin Films -- 16.3 PTO and PZT Ferroelectric Thin Films -- 16.4 Conclusions -- References -- 17. Isotopic Effect on the Lattice Constant of Germanium and Silicon Alexander Kazimirov, Jorg Zegenhagen, Evgeny Sozontov, Victor Kohn and Manuel Cardona -- 17.1 Introduction -- 17.2 Application of XSW for Precise Relative Lattice Constant Measurements -- 17.3 Experiment -- 17.3.1 Lattice constant measurements for germanium: natGe/76Ge and 70Ge/76Ge -- 17.3.2 Lattice constant measurement for silicon: nat Si/ 30Si -- 17.4 Conclusions -- References. 18. Biomembrane Models and Organic Monolayers on Liquid and Solid Surfaces S. I. Zheludeva, N. N. Novikova, M. V. Kovalchuk, N. D. Stepina, E. A. Yurieva, E. YU. Tereschenko and O. V. Konovalov -- 18.1 Introduction -- 18.2 Lipid-Protein Films on a Solid Substrate -- 18.3 Langmuir Layer on a Liquid Surface -- 18.4 Molecular Organization in Lipid-Protein Systems on Liquid Surface -- References -- 19. Applications of XSW in Interfacial Geochemistry Paul Fenter -- 19.1 Introduction -- 19.2 Cation Adsorption at the Mineral-Water Interface -- 19.3 Imaging Mineral Surface Terminations with XSW -- 19.4 Probing the Reactivity of Biofilm-Coated Minerals -- 19.5 Conclusions -- Acknowledgments -- References -- 20. Complex Surface Phases of Sb on Si(113): Combining XSW and Density Functional Theory M. Siebert, Th. Schmidt, J. I. Flege and J. Falta -- 20.1 Introduction -- 20.2 Experimental and Computational Details -- 20.3 Results and Discussion -- 20.4 Conclusion -- References -- 21. X-ray Standing Wave Analysis of Non-commensurate Adsorbate Structures Produced by

Ga Adsorption on Ge(111) Jorg Zegenhagen -- 21.1 Introduction -- 21.2 Discommensurate Reconstructions -- 21.3 XSW and STM Investigations of the Ge(111):Ga - and -phase -- 21.4 Conclusions -- References -- 22. Photon Stimulated Desorption Jan Ingo Flege, Thomas Schmidt, Jens Falta, Alexander Hille and Gerhard Materlik -- 22.1 Introduction -- 22.2 Fundamentals -- 22.3 Experimental Procedure -- 22.4 Results and Discussion -- 22.5 Conclusions -- References -- 23. Depth-Profiling of Marker Layers using X-Ray Waveguides Ajay Gupta -- 23.1 Introduction -- 23.2 Depth Profiling of Thin Marker Layers -- 23.3 Depth Profiling of Isotopic Marker Layers -- References. 24. Coherent Diffraction Imaging with Hard X-Ray Waveguides Liberato de Caro and Cinzia Giannini, Daniele Pelliccia, Alessia Cedola and Stefano Lagomarsino.

Sommario/riassunto

This volume presents the theoretical background, technical requirements and distinguished experimental highlights of the X-ray standing wave (XSW) technique. It equips scientists with the necessary information and knowledge to understand and use the XSW technique in practically all applications.
