

M.C. Desjonquères — D. Spanjaard

Concepts in Surface Physics

Second Edition



Springer

Concepts In Surface Physics

Xiao-Feng Zhang, Ze Zhang



Concepts In Surface Physics:

Concepts in Surface Physics M-C. Desjonqueres, D. Spanjaard, 2012-12-06 This textbook is intended as an introduction to surface science for graduate students. It began as a course of lectures that we gave at the University of Paris Orsay. Its main objectives are twofold: to provide the reader with a comprehensive presentation of the basic principles and concepts of surface physics and to show the usefulness of these concepts in the real world by referring to experiments. It starts at a rather elementary level since it only requires a knowledge of solid state physics, quantum mechanics, thermodynamics, and statistical physics, which does not exceed the background usually taught to students early in their university courses. However, since it finally reaches an advanced level, we have tried to render it as self-contained as possible so that it remains accessible even to an unexperienced reader. Furthermore, the emphasis has been put on a pedagogical level rather than on a technical level. In this spirit, whenever possible, models which are simplified but which contain the features that are essential to the appearance of the phenomena have been set up and solved in a completely analytical way. The logic should be transparent enough for the reader, although most often a more rigorous solution would need the use of a computer. To conclude, we have tried to give an account of surface physics which should be of use to the theoretician as well as to the experimentalist. The following comments can be made on the contents of this book.

Concepts in Surface Physics Marie-Catherine Desjonquères, Daniel Spanjaard, 1993 Now in its second edition, this successful book provides a tutorial treatment of the main concepts of the physics of crystal surfaces. Emphasis is placed on simplified calculations and the corresponding detailed analytical derivations that are able to throw light on the most important physical mechanisms underlying surface science.

Concepts in Surface Physics M. C. Desjonqueres, D. Spanjaard, 1996-03-14 **Introduction to Surface and Thin Film Processes** John Venables, 2000-08-31 This book covers the experimental and theoretical understanding of surface and thin film processes. It presents a unique description of surface processes in adsorption and crystal growth, including bonding in metals and semiconductors. Emphasis is placed on the strong link between science and technology in the description of and research for new devices based on thin film and surface science. Practical experimental design, sample preparation, and analytical techniques are covered, including detailed discussions of Auger electron spectroscopy and microscopy. Thermodynamic and kinetic models of structure are emphasised throughout. The book provides extensive leads into practical and research literature, as well as resources on the World Wide Web; see <http://venables.asu.edu/book>. Each chapter contains problems which aim to develop awareness of the subject and the methods used. Aimed as a graduate textbook, this book will also be useful as a sourcebook for graduate students, researchers, and practitioners in physics, chemistry, materials science, and engineering.

Solid Surfaces, Interfaces and Thin Films Hans Lüth, 2010-09-02 Solid Surfaces, Interfaces and Thin Films examines both experimental and theoretical aspects of surface, interface, and thin film physics. Coverage of magnetic thin films has been expanded and now includes giant magnetoresistance and the spin transfer torque mechanism. *Fractal*

Concepts in Surface Growth A.- L. Barabási, H. E. Stanley, 1995-04-13 This book brings together two of the most exciting and widely studied subjects in modern physics namely fractals and surfaces To the community interested in the study of surfaces and interfaces it brings the concept of fractals To the community interested in the exciting field of fractals and their application it demonstrates how these concepts may be used in the study of surfaces The authors cover in simple terms the various methods and theories developed over the past ten years to study surface growth They describe how one can use fractal concepts successfully to describe and predict the morphology resulting from various growth processes Consequently this book will appeal to physicists working in condensed matter physics and statistical mechanics with an interest in fractals and their application The first chapter of this important new text is available on the Cambridge Worldwide Web server <http://www.cup.cam.ac.uk/onlinepubs/Textbooks/textbookstop.html>

Frontiers in Surface Science and Interface Science

C.B. Duke, E. Ward Plummer, 2002-05-21 Any notion that surface science is all about semiconductors and coatings is laid to rest by this encyclopedic publication Bioengineered interfaces in medicine interstellar dust DNA computation conducting polymers the surfaces of atomic nuclei all are brought up to date *Frontiers in Surface and Interface Science* a milestone publication deserving a wide readership It combines a sweeping expert survey of research today with an educated look into the future It is a future that embraces surface phenomena on scales from the subatomic to the galactic as well as traditional topics like semiconductor design catalysis and surface processing modeling and characterization And great efforts have been made to express sophisticated ideas in an attractive and accessible way Nanotechnology surfaces for DNA computation polymer based electronics soft surfaces interstellar surface chemistry all feature in this comprehensive collection

Surface and Interface Science, Volumes 1 and 2 Klaus Wandelt, 2012-04-16 Covering interface science from a novel surface science perspective this unique handbook offers a comprehensive overview of this burgeoning field Eight topical volumes cover basic concepts and methods elemental and composite surfaces solid gas solid liquid and inorganic biological interfaces as well as applications of surface science in nanotechnology materials science and molecular electronics With its broad scope and clear structure it is ideal as a reference for scientists in the field as well as an introduction for newcomers

Surface Analysis

Methods in Materials Science John O'Connor, 2003-04-23 This guide to the use of surface analysis techniques now in its second edition has expanded to include more techniques current applications and updated references It outlines the application of surface analysis techniques to a broad range of studies in materials science and engineering The book consists of three parts an extensive introduction to the concepts of surface structure and composition a techniques section describing 19 techniques and a section on applications This book is aimed at industrial scientists and engineers in research and development The level and content of this book make it ideal as a course text for senior undergraduate and postgraduate students in materials science materials engineering physics chemistry and metallurgy

Surfaces and Interfaces of Solid

Materials Hans Lüth, 2013-03-09 *Surfaces and Interfaces of Solid Materials* emphasises both experimental and theoretical

aspects of surface and interface physics Beside the techniques of preparing well defined solid surfaces and interfaces basic models for the description of structural vibronic and electronic properties of interfaces are described as well as fundamental aspects of adsorption and layer growth Because of its importance for modern microelectronics special emphasis is placed on the electronic properties of semiconductor interfaces and heterostructures Experimental topics covering the basics of ultrahigh vacuum technology electron optics surface spectroscopies and electrical interface characterization techniques are presented in the form of separate panels

NEXAFS Spectroscopy Joachim Stöhr, 2013-04-17 The purpose of this book is the development of the principles and experimental techniques underlying near edge X ray absorption fine structure NEXAFS spectroscopy and the demonstration of the power of the technique for the study of the electronic and crystallographic structure of low Z molecules bonded to surfaces Low Z molecules are defined as those consisting of hydrogen carbon nitrogen oxygen and or fluorine atoms which are particularly important in surface chemistry This book is the first comprehensive treatment of the subject and presents a unified picture of theoretical and experimental concepts and results It develops all concepts from an elementary level and is suitable for students and researchers without extensive prior knowledge in X ray absorption spectroscopy On the other hand it discusses state of the art instrumentation analysis techniques and experimental and theoretical results and is therefore also suited for the advanced spectroscopist The spectra of free molecules are discussed first since their understanding provides the basis for understanding spectra of molecules bonded to surfaces the main topic of the book The connection to spectra of polymeric molecules is also made The book may therefore be of interest not only to surface scientists but also to researchers studying free molecules or polymers The various molecular adsorption systems studied by NEXAFS are tabulated Future scientific opportunities making use of the NEXAFS technique in conjunction with advanced synchrotron radiation sources are also discussed These range from element specific microscopy studies of solid surfaces to studies of molecular conformations at liquid surfaces Portola Valley CA J

Surfaces and Interfaces of Solids Hans Lüth, 2013-11-27 *Surfaces and Interfaces of Solids* emphasizes both experimental and theoretical aspects of surface and interface physics Beside the techniques of preparing well defined solid surfaces and interfaces basic models for the description of structural vibronic and electronic properties of interfaces are described as well as fundamental aspects of adsorption and layer growth Because of its importance for modern microelectronics special emphasis is placed on the electronic properties of semiconductor interfaces and heterostructures Experimental topics covering the basics of ultrahigh vacuum technology electron optics surface spectroscopies and electrical interface characterization techniques are presented in the form of separate panels

Surface Science Kurt W. Kolasinski, 2002-03-29 Offers a comprehensive modern introduction to the subject taking a truly pedagogical approach This text will provide the reader with a well rounded understanding not only of how chemistry works at surfaces but also how to understand and probe the dynamics of surface reactions

Physics of Surfaces and Interfaces Harald Ibach, 2006-11-18

This graduate level textbook covers the major developments in surface sciences of recent decades from experimental tricks and basic techniques to the latest experimental methods and theoretical understanding. It is unique in its attempt to treat the physics of surfaces, thin films and interfaces, surface chemistry, thermodynamics, statistical physics and the physics of the solid electrolyte interface in an integral manner rather than in separate compartments. It is designed as a handbook for the researcher as well as a study text for graduate students. Written explanations are supported by 350 graphs and illustrations.

Electronic Properties of Semiconductor Interfaces Winfried Mönch, 2013-04-17. Almost all semiconductor devices contain metal/semiconductor, semiconductor/insulator, metal and/or semiconductor/semiconductor interfaces and their electronic properties determine the device characteristics. This is the first monograph that treats the electronic properties of all different types of semiconductor interfaces. Using the continuum of interface-induced gap states (IFIGS) as a unifying theme, Mönch explains the band structure lineup at all types of semiconductor interfaces. These intrinsic IFIGS are the wave function tails of electron states which overlap a semiconductor band gap exactly at the interface so they originate from the quantum mechanical tunnel effect. He shows that a more chemical view relates the IFIGS to the partial ionic character of the covalent interface bonds and that the charge transfer across the interface may be modeled by generalizing Pauling's electronegativity concept. The IFIGS and electronegativity theory is used to quantitatively explain the barrier heights and band offsets of well-characterized Schottky contacts and semiconductor heterostructures respectively.

Fundamental Aspects of Heterogeneous Catalysis Studied by Particle Beams H.H. Brongersma, R.A. van Santen, 2013-03-08. Present-day heterogeneous catalysis is rapidly being transformed from a technical art into a science-based technology. A major contribution to this important change is the advance of surface spectroscopic techniques able to characterize the complex surfaces of the heterogeneous catalytic system. The Advanced Study Institute on which the current proceedings are based has as its primary aim the bringing together of a variety of lecturers outstanding in those fields of experience to enable a broad coverage of different relevant approaches. Not only catalyst characterization but also catalytic reactivity had to be covered in order to relate catalyst properties with catalyst performance. Since modern catalysis relates catalytic performance to microscopic molecular catalyst features, theoretical/electronic aspects also had to be included. The Advanced Study Institute had a unique feature in that it brought together physicists, catalytic chemists and chemical engineers whom rarely directly interact. From physics, especially new experimental possibilities of beams were emphasized. At present it is possible to obtain very detailed information on model catalysts whilst the applications to practical catalysts are gaining rapidly in sophistication. Apart from the plenary lectures, the Institute included hot topics to highlight special developments and offered participants the opportunity to present contributed papers either orally or as a poster. These contributions formed an integral part of the summer school and significantly enhanced the interaction between participants. Inclusion of the hot topics and contributed papers in these proceedings give them an added topical value. *Giant*

Magneto-Resistance Devices E. Hirota, H. Sakakima, K. Inomata, 2013-03-09 In the last decade after the discovery of giant magnetoresistance effects in metallic multilayers worldwide developments in basic research and in engineering applications have been achieved and various remarkable results have been obtained in both fields On the basic research into the GMR effects an excellent review book edited by Hartmann was published in 1999 entitled *Magnetic Multilayers and Giant Magnetoresistance* and it describes the experimental and theoretical aspects of GMR studies and the magneto optics in metallic multilayers including applications in electronic data storage fields This book aims to give an overview on the electronics applications of the GMR in metallic multilayers especially on the sensors and memories in magnetic data storage the main concerns of electronic engineers If the mean free path of conduction electrons is longer than the period of the multilayer and for a low applied magnetic field magnetizations in the adjacent magnetic layers are in antiparallel the GMR effect in magnetic metallic multilayers occurs due to the resistance change in the electric current flowing in the layer plane with a change in the magnetization from antiparallel to parallel alignment by an applied magnetic field CIP mode i.e. in the saturation field magnetizations are in parallel and the resistance is lowered The saturation field H is given by the RKKY like magnetic coupling between adjacent magnetic layers through a nonmagnetic conductive layer between the layers

Progress in Transmission Electron Microscopy 2 Xiao-Feng Zhang, Ze Zhang, 2001-10-18 Transmission electron microscopy TEM is now recognized as a crucial tool in materials science This book authored by a team of expert Chinese and international authors covers many aspects of modern electron microscopy from the architecture of novel electron microscopes advanced theories and techniques in TEM and sample preparation to a variety of hands on examples of TEM applications Volume 2 illustrates the important role that TEM is playing in the development and characterization of advanced materials including nanostructures interfacial structures defects and macromolecular complexes

Surface Reactions R.J. Madix, 2012-12-06 In the past ten years the study of the mechanisms of chemical transformations on metal surfaces has advanced appreciably Today complex reaction networks can be unraveled by combining several spectroscopies derived principally from the practice of ultrahigh vacuum surface physics Of paramount importance in this field is the combination of mass spectrometric methods for the identification of reaction products with spectroscopies which help identify surface bound reactive intermediates This quasi monograph highlights the progress in this field with studies which clearly exemplify such research and at the same time provide more general understanding of chemical reactivity at surfaces This book was constructed to be a resource to all scientists interested in the chemical reactivity of metals including those whose primary interest may lie in fields outside surface reactivity The book is intended to be an advanced case study text not a review in the standard sense Each chapter develops principles and illustrates the use of experimental methods Consequently more attention is given to experimentation than normally found in journal articles or review articles My intent in organizing these chapters was to make this field accessible to professionals and graduate students in the fields of chemistry material science

and physics Even so we hope that experts in the field of surface reactivity will also find these chapters informative After the introduction Chap 1 the book consists of chapters on the mechanism of selective oxidation by silver Chap 2 by R 1 Madix and J T *Islands, Mounds and Atoms* Thomas Michely, Joachim Krug, 2012-12-06 Crystal growth far from thermodynamic equilibrium is nothing but homoepitaxy thin film growth on a crystalline substrate of the same material Because of the absence of misfit effects homoepitaxy is an ideal playground to study growth kinetics in its pure form Despite its conceptual simplicity homoepitaxy gives rise to a wide range of patterns This book explains the formation of such patterns in terms of elementary atomic processes using the well studied Pt Pt 111 system as a reference point and a large number of Scanning Tunneling Microscopy images for visualization Topics include surface diffusion nucleation theory island shapes mound formation and coarsening and layer by layer growth A separate chapter is dedicated to describing the main experimental and theoretical methods The text is aimed at physicists with an interest in growth kinetics surface scientists graduate students and practitioners of thin film deposition

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Concepts In Surface Physics Introduction

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