Electronic Phenomena In Adsorption And Catalysis On Semiconductors And Dielectrics Reprint 1st Editi

Electronic Phenomena in Adsorption and Catalysis on Semiconductors and DielectricsSpringerElectronic Phenomena in Adsorption and Catalysis on Semiconductors and DielectricsSpringerElectronic phenomena in chemisorption and catalysis on semiconductors. Symposium on Electronic Phenomena in Chemisorption and Catalysis on Semiconductors held in Moscow, July 2-4, 1968Walter de Gruyter GmbH & Co KGElectronic Phenomena in Chemisorption and Catalysis on SemiconductorsMoscow, July 2-4, 1968. Program and Abstracts of LecturesAdsorption Processes on Semiconductor and Dielectric Surfaces ISpringer Adsorption on Ordered Surfaces of Ionic Solids and Thin Films introduces to a new and topical field of surface science for which rather little experience is available at present. It reviews the recent results of the employed analytical methods comprising all modern surface techniques including scanning tunneling microscopy and various kinds of electron spectroscopies. The present status of this new, clearly defined field of surface science is nearly completely overviewed by contributions from most of the research groups active in this field. The book is meant as a basis for the expected rapid development in this area with applications in catalysis, thin-film and semiconductor technology, sensors, electrochemistry,

controlled preparation of ultrathin epitaxial surfaces, and interfaces of insultors as well as future molecular electronics.

This book is the latest to appear in a series documenting the progress of this exciting field in surface science. It presents recent results and reviews of the rapidly growing field of interaction of particles and lasers with solid surfaces leading to excitation, ionisation and desorption. The main emphasis is on the microscopic understanding of DIET, especially electron- and ion-induced desorption of adsorbed layers, emission from insulators, laser-induced desorption and ablation, photophysics and photochemistry. Applications ranging from laser ablation for medical purposes to DIET in high-temperature superconductors are also described.

Describing novel methods and catalytic strategies to conserve and maintain air, water, and soil quality, researchers from a range of disciplines discuss the role of interface science in environmental remediation. They detail approaches to separate, reuse, recover, and treat potentially valuable materials using techniques in ion exchange and adsorption; develop and design new catalysts to enhance production, energy, and cost efficiency; and evaluate and improve existing treatment strategies for recycling of plastics and wastes. The 17 studies were developed from presentations at the symposium Application of Interface Science to Environmental Pollution Control (Chicago, August 2001).

Scanning Tunneling Microscopy II, like its predecessor, presents detailed and comprehensive accounts of the basic principles and the broad range of applications of

STM and related scanning probe techniques. The applications discussed in this volume come predominantly from the fields of electrochemistry and biology. In contrast to those in STM I, these studies may be performed in air and in liquids. The extensions of the basic technique to map other interactions are described in chapters on scanning force microscopy, magnetic force microscopy, and scanning near-field optical microscopy, together with a survey of other related techniques. Also discussed here is the use of a scanning proximal probe for surface modification. Together, the two volumes give a comprehensive account of experimental aspects of STM and provide essential reading and reference material. In this second edition the text has been updated and new methods are discussed.
Surfaces and interfaces play an increasingly important role in today's solid state devices. In this book the reader is introduced, in a didactic manner, to the essential theoretical aspects of the atomic and electronic structure of surfaces and interfaces. The book does not pretend to give a complete overview of contemporary problems and methods. Instead, the authors strive to provide simple but qualitatively useful arguments that apply to a wide variety of cases. The emphasis of the book is on semiconductor surfaces and interfaces but it also includes a thorough treatment of transition metals, a general discussion of phonon dispersion curves, and examples of large computational calculations. The exercises accompanying every chapter will be of great benefit to the student.
This book deals with adsorption and catalysis on the

surface of transition elements and their compounds, many of which are in teresting because of their particular electronic structure. The authors have worked through a vast body of experimental evi dence on the structure and properties of surfaces of transition metals and relevant oxides. Consideration is given mostly to simple (as opposed to mixed) oxides of transition elements, to common metals and to the adsorption of simple gases. A great deal of attention is paid to the nature of active surface sites responsible for chemisorption and catalytic transformations. The description relies mainly on the simplified ligand-field theory, which, however, proves quite satisfactory for predicting the adsorptive and catalytic activity of species. In many cases simple systems were explored with the aid of novel techniques, and it is only for such systems that the mechanism of the ele mentary act of adsorption and catalysis can be given adequate treatment. The present monograph has emerged from our earlier work in Russian, which appeared in the Khimiya Publishing House (Mos cow) in 1981. This English edition has, however, been revised completely to broaden its scope and to include more recent a chievements. For fruitful discussions the authors are grateful to A.A.

The idea for this book stemmed from a remark by Philip Jennings of Murdoch University in a discussion session following a regular meeting of the Australian Surface Science group. He observed that a text on surface analysis and applica tions to materials suitable for final year undergraduate and postgraduate science students was not currently available. Furthermore, the members of the Australian Surface Science group had the research experience and

range of coverage of sur face analytical techniques and applications to provide a text for this purpose. A of techniques and applications to be included was agreed at that meeting. The list intended readership of the book has been broadened since the early discussions, particularly to encompass industrial users, but there has been no significant alter ation in content. The editors, in consultation with the contributors, have agreed that the book should be prepared for four major groups of readers: - senior undergraduate students in chemistry, physics, metallurgy, materials science and materials engineering; - postgraduate students undertaking research that involves the use of analytical techniques; - groups of scientists and engineers attending training courses and workshops on the application of surface analytical techniques in materials science; - industrial scientists and engineers in research and development seeking a description of available surface analytical techniques and guidance on the most appropriate techniques for particular applications. The contributors mostly come from Australia, with the notable exception of Ray Browning from Stanford University.

This volume contains review articles written by the invited speakers at the ninth International Summer Institute in Surface Science (ISISS 1989), held at the Uni versity of Wisconsin-Milwaukee in August of 1989. During the course of ISISS, invited speakers, all internationally recognized experts in the various fields of surface science, present tutorial review lectures. In addition, these experts are asked to write review articles on their lecture topic. Former ISISS speakers serve as advisors concerning the selection of speakers and lecture topics. Emphasis is given to those areas which have not been covered in depth by recent Summer Institutes, as well as to areas which have recently gained in significance and in which important progress has been made. Because of space limitations, no individual volume of Chemistry and Physics of

Solid Surfaces can possibly cover the whole area of modern surface science, or even give a complete survey of recent progress in this field. However, an attempt is made to present a balanced overview in the series as a whole. With its comprehensive literature references and extensive subject indices, this series has become a valuable resource for experts and students alike. The collected articles, which stress particularly the gas-solid interface, have been published under the following titles: Surface Science: Recent Progress and Perspectives, Crit. Rev. Solid State Sci.

This comprehensive and up-to-date guide to the use of surface analysis methods in materials science consists of three parts : an extensive introduction to the concepts of surface structure and composition, a techniques section describing fourteen surface methods and a separate section on applications. Each chapter is written by a specialist in the field. The surface methods described include SAM, XPS, SIMS and other ion beam methods, LEED/RHEED, RBS and NRA, FTIR, SEM, STM, UPS and magnetic methods. Among the areas of application discussed are adsorption, catalysis, coated steel surfaces, inorganic surfaces, semiconductor devices, thin film solar cells and high temperature oxidation. This detailed exposition will enable researchers to select and exploit the appropriate surface method for a given application. (Midwest).

This book presents a state-of-the-art summary and critical analysis of work recently performed in leading research laboratories around the world on the implementation of metal oxide nanomaterial research methodologies for the discovery and optimization of new sensor materials and sensing systems. The book provides a detailed description and analysis of (i) metal oxide nanomaterial sensing principles, (ii) advances in metal oxide nanomaterial synthesis/deposition methods, including colloidal, emulsification, and vapor

processing techniques, (iii) analysis of techniques utilized for the development of low temperature metal oxide nanomaterial sensors, thus enabling a broader impact into sensor applications, (iv) advances, challenges and insights gained from the in situ/ex situ analysis of reaction mechanisms, and (v) technical development and integration challenges in the fabrication of sensing arrays and devices.

The present monograph represents itself as a tutorial to the ?eld of optical properties of thin solid ?lms. It is neither a handbook for the thin ?lm prac- tioner,noranintroductiontointe rferencecoatingsdesign,norareviewonthe latest developments in the ?eld. Instead, it is a textbook which shall bridge the gap between ground level knowledge on optics, electrodynamics, qu- tummechanics,andsolidstatephysicsononehand,andthem orespecialized level of knowledge presumed in typical thin ?lm optical research papers on the other hand. In writing this preface, I feel it makes sense to comment on three points, which all seem to me equally important. They arise from the following (- tually interconnected) three questions: 1. Who can bene?t from reading this book? 2. What is the origin of the particular material selection in this book? 3. Who encouraged and supported me in writing this book? Let me start with the ?rst question, the intended readership of this book. It should be of use for anybody, who is involved into the analysis of - tical spectra of a thin ?lm sample, no matter whether the sample has been prepared for optical or other applications. Thin ?lm spectroscopy may be r- evant in semiconductor physics, solar cell development, physical chemistry, optoelectronics, and optical coatings development, to give just a few ex- ples. The book supplies the reader with the necessary theoretical apparatus for understanding and modelling the features of the recorded transmission and re?ection spectra.

This field has now matured from being an exotic experimental

field into a well-established area of science. The spectroscopy of molecules and molecular adsorbates on surfaces is one area of science where synchrotron-radiation-related studies had made an impact on understanding the ground-state properties as well as the dynamics. With the new high-brightness synchrotron-radiation sources ahead, this will certainly continue to be a field of very active research.
This book deals with various physical and chemical phenomena associated with the interaction of a solid surface in a gaseous environment. The authors have gone through a vast body of experimental material on the structure and prop erties of dielectric and semiconductor surfaces from the point of view of ad sorption and catalysis. They have attempted to look into mechanisms of these processes and to outline the ways of controlling them, as long as this seemed possible. A great deal of attention is paid to considering th~ nature of ac tive surface sites responsible for chemisorption, catalytic conversion of adsorbed molecules, and certain electronic surface phenomena. All the prob lems concern physicists working in the fields of microelectronics, optoelec tronics, thin-film electronics, as well as chemists doing research in adsorp tion, catalysis, and combustion. The wide scope of surface phenomena included in this study is dealt with from a firmly established standpoint of solid state physics and the theory of chemical structure and reactivity. The roots of this monograph go back to our earlier book published with Nauka, Moscow, in 1978. The present edition has, however, been revised sub stantially and is extended to cover more grounds and, in particular, recent results. We prepared the manuscript in our native language and Mr. A. S. Dobroslavski was extremely helpful in the translation. For fruitful discussions the authors are grateful to G. F. Golovanova, Yu. A. Zarifyants, S. N. Kozlov, Z. L. Krylova, O. V. Nikitina, L. Ya.
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 compre hensive 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.

Contents: Physisorption Kinetics, The Structure of Surfaces, Dynamical Phenomena at Surfaces, Interfaces and Superlattices, Desorption Induced by Electronic Transitions, DIET II, Chemistry and Physics of Solid Surfaces VI, Low-Energy Electron Diffraction, Electronic Phenomena in Adsorption and Catalysis, Kinetics of Interface Reactions, Adsorption and Catalysis on Transition Metals and Their Oxides, Chemistry and Physics of Solid Surfaces VII, The Structure of Surfaces II, Diffusion at Interfaces: Microscopic

Concepts, Desorption Induced by Electronic Transitions, DIET III, Solvay Conference on Surface Science, Surfaces and Interfaces of Solids, Theory of the Atomic and Electronic Structure of Surfaces, Adhesion and Friction.

This is one of the first application-orientated books on the subject. The main topics are magnetic sensors with high resolutions and magnetic read heads with high sensitivities, required for hard-disk drives with recording densities of several gigabytes. Another important subject is novel magnetic random-access memory (MRAM) with non-volatile non-destructive and radiation-hard characteristics.

This book emphasises both experimental and theoretical aspects of surface, interface and thin film physics. Compared to the earlier editions, which bore the title "Surfaces and Interfaces of Solid Materials", the book now places more emphasis on thin films, including also their superconducting and ferromagnetic properties. The present 4th edition thus presents techniques of preparing well-defined solid surfaces and interfaces, fundamental aspects of adsorption and layer growth, as well as basic models for the descripti- on of structural, vibronic and electronic properties of sur- faces, interfaces and thin films. Because of their importan- ce for modern information technology, significant attention is paid to the electronic properties of semiconductor inter- faces and heterostructures. Collective phenomena , such as superconductivity and ferromagnetism, also feature prominently. Experimental sections covering essential measurement and preparation techniques are presented in separate panels.

High resolution helium atom scattering can be applied to study a number of interesting properties of solid surfaces with great sensitivity and accuracy. This book treats in detail experimental and theoretical aspects ofthis method as well as all current applications in surface science. The individual

chapters - all written by experts in the field - are devoted to the investigation of surface structure, defect shapes and concentrations, the interaction potential, collective and localized surface vibrations at low energies, phase transitions and surface diffusion. Over the past decade helium atom scattering has gained widespread recognitionwithin the surface science community. Points in its favour are comprehensiveunderstanding of the scattering theory and the availability of well-tested approximation to the rigorous theory. This book will be invaluable to surface scientists wishing to make an informed judgement on the actual and potential capabilities of this technique and its results.

This volume contains review articles written by the invited speakers at the eighth International Summer Institute in Surface Science (ISISS 1987), held at the University of Wisconsin-Milwaukee in August of 1987. During the course of ISISS, invited speakers, all internationally recognized experts in the various fields of surface science, present tutorial review lectures. In addition, these experts are asked to write review articles on their lecture topic. Former ISISS speakers serve as advisors concerning the selection of speakers and lecture topics. Em phasis is given to those areas which have not been covered in depth by recent Summer Institutes, as well as to areas which have recently gained in significance and in which important progress has been made. Because of space limitations, no individual volume of Chemistry and Physics of Solid Surfaces can possibly cover the whole area of modem surface science, or even give a complete survey of recent pro gress in the field. However, an attempt is made to present a balanced overview in the series as a whole. With its comprehensive literature references and extensive subject indices, this series has become a valu able resource for experts and students alike. The collected articles, which stress particularly the gas-solid interface, have been

published under the following titles: Surface Science: Recent Progress and Perspectives, Crit. Rev. Solid State Sci. 4, 125-559 (1974) Chemistry and Physics of Solid Surfaces, Vols. I, II, and III (CRC Press Boca Raton, FL 1976, 1979, and 1982); Vols.

Since the first edition of "Scanning 'funneling Microscopy I" has been pub lished, considerable progress has been made in the application of STM to the various classes of materials treated in this volume, most notably in the field of adsorbates and molecular systems. An update of the most recent develop ments will be given in an additional Chapter 9. The editors would like to thank all the contributors who have supplied up dating material, and those who have provided us with suggestions for further improvements. We also thank Springer-Verlag for the decision to publish this second edition in paperback, thereby making this book affordable for an even wider circle of readers. Hamburg, July 1994 R. Wiesendanger Preface to the First Edition Since its invention in 1981 by G. Binnig, H. Rohrer and coworkers at the IBM Zurich Research Laboratory, scanning tunneling microscopy (STM) has devel oped into an invaluable surface analytical technique allowing the investigation of real-space surface structures at the atomic level. The conceptual simplicity of the STM technique is startling: bringing a sharp needle to within a few Angstroms of the surface of a conducting sample and using the tunneling cur rent, which flows on application of a bias voltage, to sense the atomic and elec tronic surface structure with atomic resolution! Prior to 1981 considerable scepticism existed as to the practicability of this approach.

New and Future Developments in Catalysis is a package of seven books that compile the latest ideas concerning alternate and renewable energy sources and the role that catalysis plays in converting new

renewable feedstock into biofuels and biochemicals. Both homogeneous and heterogeneous catalysts and catalytic processes will be discussed in a unified and comprehensive approach. There will be extensive cross-referencing within all volumes. The use of solar energy during various catalytic chemical processes for the production of an array of chemical products is the theme of this volume. Photocatalysis is a topic of increasing importance due to its essential role in many of today's environmental and energy source problems. The use of solar energy for catalytic reactions results in a carbon dioxide–neutral process. All photocatalytic processes and the future developments in this area are discussed, including an economic analysis of the various processes. Offers in-depth coverage of all catalytic topics of current interest and outlines future challenges and research areas A clear and visual description of all parameters and conditions, enabling the reader to draw conclusions for a particular case Outlines the catalytic processes applicable to energy generation and design of green processes

This volume in the Springer Series on Surface Sciences presents a recent account of advances in the ever-broadening field of electron-and photon-stimulated sur face processes. As in previous volumes, these advances are presented as the proceedings of the International Workshop on Desorption Induced by Electronic Transitions; the

fifth workshop (DIET V) was held in Taos, New Mexico, April 1-4, 1992. It will be abundantly clear to the reader that "DIET" is not restricted to desorption, but has for several years included photochemistry, non-thermal surface modification, exciton self-trapping, and many other phenomena that are induced by electron or photon bombardment. However, most stimulated surface processes do share a common physics: initial electronic excitation, localization of the excitation, and conversion of electronic energy into nuclear kinetic energy. It is the rich variation of this theme which makes the field so interesting and fruitful. We have divided the book into eleven parts in order to emphasize the wide range of materials that are examined and to highlight recent experimental and theoretical advances. Naturally, there is considerable overlap between sections, and many papers would be appropriate in more than one part. Part I focuses on perhaps the most active area in the field today: electron attachment. Here the detection and characterization of negative ions formed by attachment of elec trons supplied externally from the vacuum are discussed. In addition, the first observations of negative ions formed by substrate photoelectrons are presented. Scanning Tunneling Microscopy III provides a unique introduction to the theoretical foundations of scanning tunneling microscopy and related scanning probe methods. The different theoretical concepts

developed in the past are outlined, and the implications of the theoretical results for the interpretation of experimental data are discussed in detail. Therefore, this book serves as a most useful guide for experimentalists as well as for theoreticians working in the field of local probe methods. In this second edition the text has been updated and new methods are discussed.

This is the first ever comprehensive treatment of NEXAFS spectroscopy. It is suitable for novice researchers as an introduction to the field, while experts will welcome the detailed description of state-of-the-art instrumentation and analysis techniques, along with the latest experimental and theoretical results.

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.

This unified overview of recent progress in a growing, multi-disciplinary field places special emphasis on the industrial applications of magnetic multilayered materials. The text describes a wide range of physical aspects, together with experimental and theoretical methods.

A wide-ranging description of recent progress and new approaches for researchers and graduate students in microscopy and materials science.

The articles collected in this volume give a broad overview of the current state of surface science. Pioneers in the field and researchers met together at this Solvay Conference to discuss important new developments in surface science, with an emphasis on the common area between solid state physics and physical chemistry. The contributions deal with the following subjects: structure of surfaces, surface science and catalysis, two-dimensional physics and phase transitions, scanning tunneling microscopy, surface scattering and surface dynamics, chemical reactions at surfaces, solid-solid interfaces and superlattices, and surface studies with synchrotron radiation. On each of these subjects an introductory review talk and a number of short research contributions are followed by extensive discussions, which appear in full in the text. This nineteenth Solvay Conference commemorates the 75th anniversary of the Solvay Institutes.

This third edition has been thoroughly revised and updated. In particular it now includes an extensive discussion of the band lineup at semiconductor interfaces. The unifying concept is the continuum of interface-induced gap states. This book is the third in a three-volume series treating the

adsorptive, catalytic and electronic properties of solid surfaces. The authors are the first to treat surface chemical bonding in compounds of transition metals from a unified viewpoint taking ideas from both physics and chemistry. This volume gives an account of active sites in complexes and on the surfaces of metals and oxides in terms of the electronic structure of transition metal atoms. Possible mechanisms of interaction of simple molecules with such active sites are also discussed. All chemists and physicists concerned with the study of catalysis, adsorption and surface phenomena should find this book useful and interesting.

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.

This book presents experimental data and recent results of model calculations on the formation of natural oxide film on metal surfaces and of metal hydride formation. Such films are responsible for corrosion, friction, and wear of metallic materials. Describing mostly the authors own research, this monograph gives an overview of models suitable for metal-gas reactions and demonstrates how complex metal-gas interactions can be analyzed by standard procedures of chemical kinetics. The book, and the data and equations it

contains, will be useful to researchers in surface science, condensed-matter physics, and materials science.
A treatment of the important aspects of physical chemistry on metal surfaces, including selective oxidation, desulfurization, cyclization, metal-organic chemical vapor deposition, alkane activation and hydrogen dissociation dynamics. Case studies focus on on the chemistry of selected systems, rather than the techniques, to convey the excitement of recent developments.