

L. N. Rhodin and G. Ertl, editors

THE NATURE OF THE SURFACE CHEMICAL BOND



North-Holland

Nature Of The Surface Chemical Bond

**Anders Nilsson,Lars G.M.
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Nature Of The Surface Chemical Bond:

The Nature of the Surface Chemical Bond Thor N. Rhodin, Gerhard Ertl, 1979 **The Nature of the Surface Chemical Bond**, 1979 *The Chemical Bond* Gernot Frenking, Sason Shaik, 2014-07-08 A unique overview of the different kinds of chemical bonds that can be found in the periodic table from the main group elements to transition elements lanthanides and actinides It takes into account the many developments that have taken place in the field over the past few decades due to the rapid advances in quantum chemical models and faster computers This is the perfect complement to Chemical Bonding Fundamentals and Models by the same editors who are two of the top scientists working on this topic each with extensive experience and important connections within the community **Chemical Bonding at Surfaces and Interfaces** Anders Nilsson, Lars G.M. Pettersson, Jens Norskov, 2011-08-11 Molecular surface science has made enormous progress in the past 30 years The development can be characterized by a revolution in fundamental knowledge obtained from simple model systems and by an explosion in the number of experimental techniques The last 10 years has seen an equally rapid development of quantum mechanical modeling of surface processes using Density Functional Theory DFT Chemical Bonding at Surfaces and Interfaces focuses on phenomena and concepts rather than on experimental or theoretical techniques The aim is to provide the common basis for describing the interaction of atoms and molecules with surfaces and this to be used very broadly in science and technology The book begins with an overview of structural information on surface adsorbates and discusses the structure of a number of important chemisorption systems Chapter 2 describes in detail the chemical bond between atoms or molecules and a metal surface in the observed surface structures A detailed description of experimental information on the dynamics of bond formation and bond breaking at surfaces make up Chapter 3 Followed by an in depth analysis of aspects of heterogeneous catalysis based on the d band model In Chapter 5 adsorption and chemistry on the enormously important Si and Ge semiconductor surfaces are covered In the remaining two Chapters the book moves on from solid gas interfaces and looks at solid liquid interface processes In the final chapter an overview is given of the environmentally important chemical processes occurring on mineral and oxide surfaces in contact with water and electrolytes Gives examples of how modern theoretical DFT techniques can be used to design heterogeneous catalysts This book suits the rapid introduction of methods and concepts from surface science into a broad range of scientific disciplines where the interaction between a solid and the surrounding gas or liquid phase is an essential component Shows how insight into chemical bonding at surfaces can be applied to a range of scientific problems in heterogeneous catalysis electrochemistry environmental science and semiconductor processing Provides both the fundamental perspective and an overview of chemical bonding in terms of structure electronic structure and dynamics of bond rearrangements at surfaces **Chemical Bonds Outside Metal Surfaces** Norman H. March, 2012-12-06 The problem of molecules interacting with metal surfaces has for a very long time been recognized to be of considerable technological as well as fundamental importance Thus in the former category a

substantial number of important synthetic reactions for industrial purposes make use of metal surfaces as catalysts Or again problems of corrosion of metals are of great practical importance such as in nuclear reactor technology see for instance my earlier articles in Physics Bulletin Volume 25 p 582 Institute of Physics UK 1974 and in Physics and Contemporary Needs Riazuddin ed Vol 1 p 53 Plenum Press New York 1977 It is therefore of significance to strive to gain a more fundamental understanding of the atomic and ultimately the electronic processes that occur when a molecule is brought into the proximity of a metal surface The present volume focuses mainly on the theory and concepts involved however it is intended for readers in chemistry physics and materials science who are not specialists in theory but nevertheless wish to learn more about this truly interdisciplinary area of theoretical science The aim of the book is to present the way in which valence theory can be synthesized with the understanding of metals that has been gained over the last half century or so While advanced theory has at times been necessary is largely presented in an extensive set of Appendixes

The Chemical Physics of Surfaces S.R. Morrison, 2013-06-29 of available information Even more importantly some authors who have contributed substantially to an area may have been overlooked For this I apologize I have however not attempted to trace techniques or observations historically so there is no implication unless specified that the authors referred to were or were not the originators of a given method or observation I would like to acknowledge discussions with co workers at SFU for input relative to their specialties to acknowledge the help of students who have pointed out errors and difficulties in the earlier presentation and to acknowledge the infinite patience of my wife Phyllis while I spent my sabbatical and more in libraries and punching computers

S Roy Morrison 0 1 Contents Notation XV 1 Introduction 1 1 1 Surface States and Surface Sites 1 1 1 1 The Chemical versus Electronic Representation of the Surface 1 1 1 2 The Surface State on the Band Diagram 4 1 1 3 The Fermi Energy in the Surface State Model 6 1 1 4 Need for Both Surface Site and Surface State Models 6 1 2 Bonding of Foreign Species to the Solid Surface 7 1 2 1 Types of Interaction 7 1 2 2 The Chemical Bond 10 1 2 3 Acid and Basic Surface Sites on Solids 13 1 2 4 Adsorbate Bonding on Various Solid Types 16 1 2 5 Movement of Surface Atoms Relaxation Reconstruction and Relocation

Cohesion and Structure of Surfaces K. Binder, M. Bowker, J.E. Inglesfield, P.J. Rous, 1995-12-18 During the past fifteen years there has been a dramatic increase in the number of different surfaces whose structures have been determined experimentally For example whereas in 1979 there were only 25 recorded adsorption structures to date there are more than 250 This volume is therefore a timely review of the state of the art in this dynamic field Chapter one contains a compilation of the structural data base on surfaces within a series of tables that allows direct comparison of structural parameters for related systems Experimental structural trends amongst both clean surfaces and adsorbate systems are highlighted and discussed The next chapter outlines the successes of local density functional theory in predicting the relaxations and reconstructions of clean metal and semiconductor surfaces and the behaviour of adsorbates such as hydrogen oxygen and alkali elements on metal surfaces thereby explaining some of the experimental trends observed

within the database These ab initio density functional calculations are of ground state properties at the absolute zero of temperature Chapter three provides an introduction to finite temperature effects in a pedagogical review of current statistical mechanical treatments of phase transitions at surfaces many of which display the prominent role of fluctuations or non mean field behaviour The final chapter discusses the relationship of the reactivity of a surface to its morphology and composition which is particularly relevant to a fundamental understanding of catalysis *Modern Heterogeneous Catalysis*

Rutger A. van Santen, 2017-06-19 Written by one of the world's leading experts on the topic this advanced textbook is the perfect introduction for newcomers to this exciting field Concise and clear the text focuses on such key aspects as kinetics reaction mechanism and surface reactivity concentrating on the essentials The author also covers various catalytic systems catalysis by design and activation deactivation A website with supplementary material offers additional figures original material and references

The Handbook of Surface Imaging and Visualization Arthur T. Hubbard, 2022-04-19 This exciting new handbook investigates the characterization of surfaces It emphasizes experimental techniques for imaging of solid surfaces and theoretical strategies for visualization of surfaces areas in which rapid progress is currently being made This comprehensive unique volume is the ideal reference for researchers needing quick access to the latest developments in the field and an excellent introduction to students who want to acquaint themselves with the behavior of electrons atoms molecules and thin films at surfaces It's all here under one cover The Handbook of Surface Imaging and Visualization is filled with sixty four of the most powerful techniques for characterization of surfaces and interfaces in the material sciences medicine biology geology chemistry and physics Each discussion is easy to understand succinct yet incredibly informative Data illustrate present research in each area of study A wide variety of the latest experimental and theoretical approaches are included with both practical and fundamental objectives in mind Key references are included for the reader's convenience for locating the most recent and useful work on each topic Readers are encouraged to contact the authors or consult the references for additional information This is the best ready reference available today It is a perfect source book or supplemental text on the subject [Mechanisms In Heterogeneous Catalysis](#) Rutger A Van Santen, 2023-06-28

Heterogeneous catalysis has developed over the past two centuries as a technology driven by the needs of society and is part of Nobel Prize winning science This book describes the spectacular increase in molecular understanding of heterogeneous catalytic reactions in important industrial processes Reaction mechanism and kinetics are discussed with a unique focus on their relation with the inorganic chemistry of the catalyst material An introductory chapter presents the development of catalysis science and catalyst discovery from a historical perspective Five chapters that form the thrust of the book are organized by type of reaction reactivity principles and mechanistic theories which provide the scientific basis to structure function relationships of catalyst performance Present day challenges to catalysis are sketched in a final chapter Written by one of the world's leading experts on the topic this definitive text is an essential reference for students researchers and

engineers working in this multibillion dollar field

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