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BOOK REVIEW

Chemistry and Physics of Solid Surfaces VIII. Edited by R. VANSELOW AND R. HOWE. **Springer Series in Surface Sciences,** Vol. 22. Springer-Verlag, Berlin/New York, 1990.

This is a delightful addition to a series which might aptly be subtitled "Yearbook of Surface Science." It continues the tradition of reviewing the state of the art in understanding of surface phenomena and development of new analytical tools, while putting these solidly in both the appropriate scientific and historical context. Of the 18 chapters included, those likely to be of particular interest to catalysis researchers include "Reactivity of Surfaces" (G. Ertl), "New Mechanisms for the Activation and Desorption of Molecules at Surfaces" (S. T. Ceyer), "Photochemistry of Adsorbate-Metal Interfaces: Intra-Adsorbate Bond Breaking" (J. M. White), "Transition Metal Clusters and Isolated Atoms in Zeolite Cages" (W. M. Sachtler), and "Chaos in Surface Dynamics" (J. W. Gadzuk). Also included are chapters on structural characterization of adsorbate layers by electron stimulated desorption (ESD), of surface structure by low energy position diffraction (LEPD), time-of-flight scattering and recoiling spectrometry (TOF-SARS), and photoemission of adsorbed xenon (PAX). A number of approaches to imaging of surfaces are also discussed, including scanning electron microscopy with polarization analysis, low energy electron microscopy, and scanning probe techniques such as scanning tunneling microscopy and atomic force microscopy. Also included are several chapters on not-yet-routine approaches to understanding surface reaction pathways and kinetics, including the use of second-harmonic and sum-frequency generation (SHG and SFG) and the application of high electric fields to induce formation of or to alter the stability of surface chemical species.

As the book is organized along the lines of physical techniques, one might conclude that it would be of interest primarily to those engaged in catalyst characterization and, further, that most of the techniques discussed are sufficiently exotic to be of limited application to technical catalysts in the near future. That would be a mistake. There are a number of reasons that those engaged in catalysis science should wish to keep abreast of the developments discussed in "The Chemistry and Physics of Solid Surfaces." First, although the "alphabet soup" of extant characterization techniques is rather dense, and although many such techniques are of limited utility for high surface area materials, others have clearly become mainstays of surface analysis. One should not underestimate the techniques one may be utilizing tomorrow (scanning tunneling microscopy is, after all, less than a decade old). The authors of the individual chapters in this book do an excellent job of delineating which techniques are applicable to heterogeneous surfaces, and which are, for the moment, restricted to well-defined single crystals. Two better reasons to consider this book are the concepts and quantitative information it contains. For example, no fewer than 85 specific systems are indexed under adsorption. The chapters which consider chemical reactions on surfaces provide welcome insights into surface phase transitions, complex reaction kinetics, dynamics of molecular activation, and methods for quantitative determination of the kinetics of elementary steps. These should be required reading for anyone attempting to interpret catalytic kinetics in mechanistic detail. The field is also likely to see an explosion of interest in application of scanning probe techniques to real and model heterogeneous catalysts, and the last four chapters of this book provide a useful introduction for those of us still trying to catch up to developments in this area. All in all, this book will be a valuable addition to the library of anyone concerned with fundamental aspects of heterogeneous catalysis.

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