JOURNAL OF SOLID STATE CHEMISTRY 82, 307–308 (1989)

BOOK REVIEWS

Catalysis at Surfaces. By IAN M. CAMPBELL. Chapman and Hall, New York/London, 1988. 250 pp., $65.00 ($25.50, paper).

"Catalysis at Surfaces," written primarily for undergraduates and beginning graduate students, is a great introductory book for those interested in the role of surfaces in heterogeneous catalysis.

The first chapter contains introductory material, including definition of terms, classification of reactions, and an historical perspective. Chapter 2 is an introduction to the surface processes important in catalysis, including classifications of catalysts and enzymes, thermodynamic aspects, and kinetics, as well as practical information concerning the design of microcalorimeters. Chapter 3 is an introduction to catalytic surfaces; metals, microporous solids, liquid phase, immobilized and anchored materials, grafted catalysis, and oxide surfaces are discussed, followed by a treatment of specific details of oxides and zeolites.

Chapter 4 covers surface and bulk characterization methods. The major classification used by the author is destructive versus nondestructive methods. Single-crystal surface phenomena are briefly mentioned and the principles of thermal desorption, secondary ion mass spectrometry, low-energy electron diffraction, electron energy loss spectroscopy, Auger electron spectroscopy, photoelectron spectroscopy, extended X-ray absorption fine structure, and infrared methods are given. These methods are primarily surface methods, in line with the emphasis of this book. Chapter 5 deals with chemisorption phenomena of metals, oxides, and solid acids.

The last three chapters are more specifically oriented to catalytic reactions of current interest. Chapter 6 summarizes catalytic reactions characteristic of metals, oxides, and solid acids, with major emphasis placed on mechanisms of these reactions and catalytic surface intermediates. Chapter 7 covers the role of enzymes in catalysis, including the roles of active sites, pH dependence, metal centers in enzymes, and specific industrial uses of enzymes, including corn syrup, cocoa butter, polyphenylene, penicillin, and L-aspartic acid processes. Chapter 8 summarizes industrial processes that use solid catalysts, including hydrogenation, ammonia production, nitric acid synthesis, methanol synthesis, ethylene oxide, sulfuric acid, polymer, catalytic cracking, synthetic gasoline, and zeolite catalysis.

Particular strengths of the book include good writing style, numerous figures and tables, and excellent organization. This book gives an excellent perspective of surface processes that occur in catalytic systems.

STEVEN L. SUIB

Department of Chemistry
University of Connecticut
Storrs, Connecticut 06269-3060

Methods of Surface Analysis. Edited by J. M. WALLS. Cambridge University Press, Cambridge/New York, 1989. 342 pp., $80.00.

This book's nine chapters cover practical aspects of surface analysis. Although written by nine different contributors, the book reads very well for an intended audience of academic and industrial researchers. Chapter 1 (Walls) is an introductory chapter dealing with ultrahigh vacuum and methods generally used for surface analysis, including sputtered neutral mass spectrometry, laser microprobe, and atom probe measurements. Tables comparing advantages and disadvantages of various methods are given. Chapter 2 (R. Smith and Walls) is titled "Ion Erosion in Surface Analysis." Different types of ion sources, sputtering, ion-induced physical changes, and depth profiling are described with several diagrams and photographs to help the reader understand fundamental principles.

Chapter 3 (M. P. Seah) covers ion and electron energy analysis, including Auger electron and X-ray photoelectron spectroscopy and a thorough discussion of cylindrical mirror and hemispherical energy analyzers. Performance of commercial spectrometers is tabulated. Chapter 4 (H. E. Bishop) focuses on Auger electron spectroscopy; Auger effect, electron scattering, spatial resolution, type of incident energy and detector, use of ion guns for sputtering, aspects of automation, quantitative, crystallographic, and chemical effects, point analysis, depth profiling, and Auger imaging are discussed.

Chapter 5 (A. B. Christie) covers X-ray photoelectron spectroscopy. The photoelectric effect, photoionization cross sections, lineshapes, chemical shifts, inelastic scattering, and escape depths are pre-

0022-4596/89 $3.00

sented, followed by a discussion of the source, detector, and accessory components. There is a good discussion of peak assignments and data analysis procedures, including spatial resolution, multichannel detection, and automated analysis.

Chapter 6 (J. C. Vickerman) deals with static secondary ion mass spectrometry and covers sputtering, secondary ion emission, spectrometer components, and data analysis, with specific examples from studies of metals, thin films, surface reactions, oxidations, alloys, zeolites, and polymers. Chapter 7 (D. E. Sykes) is on dynamic SIMS. Basic principles, matrix effects, preferential sputtering, quantification, and the major types of analysis (including ion energy, ion imaging, and ion microscopy) are presented. The importance of interferences, energy filtering, resolution, and dynamic range is stressed, as are applications to geological, biological, and materials sciences.

Chapter 8 (D. G. Armour) covers ion scattering spectroscopy. Basic principles of ion yield, atomic collisions, shadowing, multiple scattering effects, instrumentation, quantification, and applications (primarily on metal surfaces) are described. Chapter 9 (W. A. Grant) covers Rutherford backscattering. Physical concepts and backscattering instrumentation (including scattering cross section, energy loss, depth scale, and height spectra) are discussed and examples applied to metal films, diffusion at surfaces, impurities, defect structure, and surface structure are presented.

Overall, this book is a pleasure to read and will serve as a practical guide for those interested in surface analysis using these specific methods. It would also serve as an excellent introductory text for undergraduate and beginning graduate students interested in surface science.

STEVEN L. SUIB

Department of Chemistry
University of Connecticut
Storrs, Connecticut 06269-3060