JOURNAL OF CATALYSIS 54, 454–456 (1978)

BOOK REVIEWS

Catalysis: Heterogeneous and Homogeneous. Edited by B. DELMON and G. JANNES. Elsevier Scientific Publishing Company, Amsterdam and New York, 1975. xxv + 547 pp. Dfl. 160.

These are the "Proceedings of the International Symposium on the Relations between Heterogeneous and Homogeneous Catalysis Phenomena" held in Brussels in October 1974. As the subtitle suggests, the purpose of this symposium was to emphasize the common features of homogeneous and heterogeneous catalysis.

The book includes 28 submitted and 10 invited papers and their discussions. The editors have added a useful introduction that guides the reader into the material included in the book. Overall, the works presented are of a good scientific level, but, as always occurs in the Proceedings of a Meeting like this, there is a wide variation in the depth, scope and importance of the contributions. Special emphasis was placed on trying to interpret fundamental aspects of heterogeneous catalysis in terms of the more well known chemistry of homogeneous systems (coordination chemistry). The discussion was mostly based on common structural features and spectroscopic observations. Refined kinetic and tracer work are rare. The techniques of epr and ir analysis were frequently used for basic structural work, most often in combination with spectra-sensitive CO and NO analysis. Those papers in which kinetic data were presented pointed to a close mechanistic similarity between heterogeneous and homogeneous catalysis. On the homogeneous side, the main approach was the heterogenization of homogeneous catalysts. It was hoped that this would provide another view of the relationship between homogeneous and heterogeneous catalysis. Three heterogenization methods were used: formation of a metal–carrier bond, impregnation followed by evaporation of the solution, and reaction with macromolecular ligands. This approach did not yield as much information as expected. The heterogenized catalysts were either too different from, or very similar to, their homogeneous counterparts. No gradual change in properties was observed. Besides these general observations, many of the papers provided useful material for those working in the field. I found particularly interesting a few papers in which a systematic attempt was made to compare the catalytic properties of homogeneous catalysts and their heterogenized counterparts for a given test reaction. In the same vein, the heterogenization of Wilkinson catalysts provided another set of data for comparison. The bifunctionality of heterogenized complexes, also reported in this book, opens an exciting avenue for further research. Several other papers were comprehensive studies in which different techniques were coupled with kinetics measurements to establish relationships between activity and structure; these undoubtedly will contribute to a better understanding of the catalytic process.

In summary, these proceedings cover an interesting overlapping area of both homogeneous and heterogeneous catalysis that makes this a useful reference book for those working in catalytic research.

EDUARDO A. LOMBARDO

Facultad de Ingeniería Química
Instituto de Catalisis y Petroquímica
3000 Santa Fe, Argentina

Platinum–Iridium Reforming Catalysts. By J. C. RASSER. Delft University Press, 1977. 232 pp., paperbound, $24.00.

This book appears to be the doctoral thesis of J. Rasser, containing work done while a member of Professor J. Scholten's research group. Chapter 1 reviews the theory of temperature-programmed desorption (TPD) and makes some minor extensions. An extra feature of this chapter is a discussion of the effect which temperature dependence of the preexponential factor has on the various derived equations. Chapter 2 is largely concerned with an analysis of the theoretical lineshapes predicted by the equations of Chapter 1. Special attention is given to the peak width at half maximum which can be a particularly useful parameter for characterizing the desorption process. Chapter 3 mainly consists of a summary of thermochemical data on the Pt–Ir system. Chapter 4 may be considered the heart of the treatise and deals with the TPD of hydrogen from a number of materials varying in metal composition from pure Pt to pure Ir. Included

0021-9517/78/0543-0454$02.00/0

are bulk metals and alloys, alumina-supported catalysts of high and low loadings, and silica- and carbon-supported catalysts. The quality of the experimental work is quite good. Chapter 5 deals primarily with the reforming of heptane over the various alumina-supported catalysts and attempts to correlate this data with information from the preceding chapters. A final short chapter, Chapter 6, compares the results to published data on these systems. For the most part the information obtained by TPD corroborates and somewhat extends the current status of these systems.

This text is well written and easy to read except for a small number of inconveniences, such as placing Table 7 of Chapter 4 between Tables 1 and 2. An unfortunate feature of the systems studied is that the TPD chromatograms of hydrogen are very similar for all compositions of the unsupported metals. Also, the desorption peaks for the supported metals are rather broad and overlapping. Nonetheless, Rasser gives a detailed analysis of the experiments and is able to extract some useful information. The experimental data pertaining to catalytic activity is less detailed. It would have been especially helpful if the selectivity of the various catalysts were compared at the same percentage conversion. The main limitation of the text is its narrow scope; it also lacks an index. However, the book should be useful to scientists interested in TPD studies of practical catalysts or the chemistry of Pt–Ir catalysts.

ALAN BRENNER

Department of Chemistry
Wayne State University
Detroit, Michigan 48202

The Chemical Physics of Surfaces. S. ROY MORRISON. Plenum Press, New York and London, 1977. 415 pp., $39.50.

The word "The" in the title of the book makes the publication sound more ambitious than the author can keep up with and more ambitious than he obviously had planned. In the preface he writes: "The objective of this work has therefore been to describe the results and current models of surface science spanning a broad gray area between surface physics and surface chemistry with some overlap into each of these disciplines." The main chapter headings may give the prospective buyer an idea of the contents:

1. Introduction, 1.1 Surface States and Surface Sites;
2. Space Charge Effects, 2.1 General, 2.2 Space Charge Effects with Reactive Surface Species, 2.3 Electron Hole Transfer between the Solid and its Surface;
3. Experimental Methods, 3.1 Surface Measurements Based on Electrical and Optical Techniques, 3.2 Surface Spectroscopies, 3.3 Chemical Measurements;
4. Adsorbate-Free Surface, 4.1 Introduction, 4.2 Theoretical Models, 4.3 Measurements on Adsorbate-Free Ionic Solids, 4.4 Measurements on Adsorbate-Free Covalent or Metallic Solids;
5. Bonding of Foreign Species of the Solid Surface, 5.1 Reconstruction and Relocation in Bonding, 5.2 The Semiclassical Model of Bonding: The Surface Molecule, 5.3 Quantum Models of the Adsorbate/Solid Bond, 5.4 Measurement of Adsorbate Surface States on Covalent or Metallic Solids, 5.5 The Chemistry of Surface States, 5.6 The Formation of Surface State Bonds;
6. Nonvolatile Foreign Additives on the Solid Surface, 6.1 General, 6.2 Dispersion of Additives, 6.3 The Cluster, the Transition between a Molecule and a Solid, 6.4 The Control of Surface Properties with Additives, 6.5 The Real Surface;
7. Adsorption, 7.1 Adsorption Isoterms and Isobars, 7.2 Ionosorption on Semiconductors, 7.3 Adsorption with Local Bonding;
8. The Solid/Liquid Interface, 8.1 Introduction, 8.2 Theory, 8.3 Observation with Semiconductor Electrodes, 8.4 Comparison of Solid/Liquid with the Solid/Gas Interface;
9. Photoeffects at Semiconductor Surfaces, 9.1 General, 9.2 Single Hole/Electron Recombination, 9.3 Photoadsorption and Photodesorption, 9.4 Photocatalysis, 9.5 Direct Excitation of Surface States by Photons;
10. Surface Sites in Heterogeneous Catalysis, 10.1 General Concepts, 10.2 Surface Sites Associated with Steps and Other Geometrical Factors, 10.3 The Role of Acid and Base Sites in Catalytic Reactions, 10.6 Covalent Bonding to Coordinatively Unsaturated Metal and Cationic Sites, 10.6 Examples of Oxidation Catalysis.

The author focuses his attention on surface bonding orbitals, sites, and states and discusses, often very briefly, a considerable number of techniques for surface analysis. The treatment is limited to solid/gas and solid/liquid interfaces. Even with these given limits, the writing of such a book is a bold enterprise. Most subdisciplines are still expanding at a considerable rate, the accumulated material is enormous, and the various analytical techniques are reaching a respectable number. Therefore, it is no wonder that most surface science books, which were published during recent years,