

BOOK REVIEWS

Heterogeneous Catalysis and Fine Chemicals III. Edited by M. Guisnet, J. Barbier, J. Barrault, C. Bouchoule, D. Duprez, G. Perot, and C. Montassier. *Studies in Surface Science and Catalysis*, Vol. 78, Elsevier, Amsterdam, 1993. 719 pp.

This book contains the proceedings of the Third Symposium on Heterogeneous Catalysis and Fine Chemicals held in Poitiers, France, April 5-8, 1993. The first section is composed of the four plenary lectures given at the symposium. The first (I. Dodson) discusses the use of metal catalysts for the preparation of hydrofluorocarbons (HFCs) to replace the present ozone-depleting chlorofluorocarbons (CFCs), heterogeneous asymmetric hydrogenations, and some new approaches to the development of improved supported bimetallic catalysts. The lecture on catalytic oxidation with H_2O_2 (M. G. Clerici) covers the use of metalloporphyrins, platinum phosphine complexes, phase transfer agents, and titanium silicalite as catalysts for the reactions of hydrogen peroxide with a wide range of substrates. The third plenary lecture (H. Hattori) covers the various uses of solid base catalysts in the synthesis of fine chemicals. The reactions discussed are double bond isomerization, aminations, dehydrations, and alkylations along with various condensation reactions such as the aldol, Wittig-Horner, and Knoevenagel reactions. The solid bases mentioned are the alkali-substituted zeolites, metal oxides, solid superbases, and nonmetal oxide materials. Rounding out the plenary lectures is a thorough coverage of solvent effects in heterogeneous catalysis as applied to fine chemical synthesis (L. Gilbert and C. Mercier).

The plenary lectures are followed by 82 papers which were either oral presentations or given as posters at the symposium. These papers are divided into three sections; hydrogenations and related reactions, oxidations, and acid-base catalysis. Almost half of these papers are concerned with hydrogenations, and the remainder are divided two-to-one between the acid-base catalysis and oxidation sections. The primary theme of the hydrogenation papers is the improvement of the selectivity of the hydrogenation of multifunctional molecules, such as the conversion of α - β -unsaturated aldehydes to unsaturated alcohols and the hydrogenation of nitriles to primary amines. The oxidation papers cover a variety of reactions ranging from the photochemical oxidation of alcohols and hydrocarbons to the oxidation of water-insoluble alcohols with dioxygen and selective oxidations by hydrogen peroxide promoted by titanium zeolites. The papers in the acid-base catalysis section represent many of the newer applications of heterogeneous catalysis to organic synthesis. These range from the acid-zeolite-promoted Friedel-Crafts reaction and the Beckmann and other rearrangements to the montmorillonite-promoted Diels-Alder reaction and the shape-selective Fischer indole synthesis. Several papers describe multistep catalytic processes, showing the degree of sophistication which is being introduced into heterogeneously catalyzed procedures.

The range of interest in the use of heterogeneous catalysts in organic synthesis is shown by the distribution of laboratories from which the papers are produced. About 50% of the general papers come from universities, 30% from government supported labs, and about 20% from industry. While most of the papers describe liquid-phase processes, about 30% of the papers discuss vapor-phase procedures which are applicable

to synthesis. This shows how interest in more efficient flow procedures has been extended into the preparation of fine chemicals.

As in any multicontributor book, there is some disparity in the ease of reading and thoroughness from paper to paper, but, on the whole, this text represents a major contribution to the use of catalysis in organic synthesis. It should be of interest not only to researchers already involved in the use of heterogeneous catalysts for the synthesis of organic compounds, but also to those engaged in more classic catalytic research. The general synthetic chemist can also benefit from the information contained here, as it shows just how versatile heterogeneous catalysis can be. This text joins the previously published proceedings of the first and second conferences as an important resource for the synthetic chemist.

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Catalysis: An Integrated Approach to Homogeneous, Heterogeneous and Industrial Catalysis. Edited by J. A. Moulijn, P. W. N. M. van Leeuwen, and R. A. van Santen. Elsevier, Amsterdam/London/New York/Tokyo, 1993. xviii + 460 pp. \$168.50.

This book, Volume 79 in the series *Studies in Surface Science and Catalysis*, was written by a group of Dutch chemists and chemical engineers: E. B. M. Doesburg, J. W. Geus, F. Kapteijn, G. B. Marin, J. A. Moulijn, J. W. Niemantsverdriet, B. E. Nieuwenhuys, V. Ponc, J. J. F. Scholten, R. A. Sheldon, A. Tarfaoui, H. van Bekkum, J. H. C. van Hooft, G. van Koten, P. W. N. M. van Leeuwen, R. A. van Santen, and J. A. R. van Veen. The editors' goal was to present an integrated statement of homogeneous, heterogeneous, and industrial catalysis emphasizing a molecular approach.

The sequence of chapters is as follows: 1, History of Catalysis; 2, Catalytic Processes in Industry; 3, Chemical Kinetics of Catalyzed Reactions; 4, Bonding and Elementary Steps in Catalysis; 5, Heterogeneous Catalysis; 6, Homogeneous Catalysis with Transition Metal Complexes; 7, Catalytic Reaction Engineering; 8, Preparation of Catalyst Supports and Zeolites; 9, Preparation of Supported Catalysts; 10, Catalyst Characterization with Spectroscopic Techniques; 11, Temperature Programmed Reduction and Sulfiding; 12, The Use of Adsorption Methods for the Assessment of the Surface Area and Pore Size Distribution of Heterogeneous Catalysts; and 13, Future Trends.

The first two chapters are brief and largely qualitative statements of case studies. The kinetics chapter is conventional and short. That concerned with bonding and elementary steps juxtaposes standard information about surfaces and transition metal complexes (without much of an attempt to link them) along with some information about carbocation reactions and reactions on metal oxide surfaces. The chapter focused on heterogeneous catalysis adopts a case study approach, with thoughtful, brief summaries of Fischer-Tropsch chemistry, hydrogenation/de-

hydrogenation and hydrogenolysis reactions of hydrocarbons on metals, and ethylene oxidation on silver. The chapter about homogeneous catalysis is an up-to-date summary of catalytic hydroformylation, olefin polymerization, and chiral hydrogenation; it is characterized by depth and insight and is a good teaching tool. The catalytic reaction engineering chapter is a condensed summary of textbook material with many equations but little insight; it dangles. The chapter about preparation of catalyst supports and zeolites is mostly recipes. The chapter about preparation of supported catalysts is discerning and informative, presenting a concise summary of an underrepresented subject in the catalysis literature. The chapter concerned with catalyst characterization by spectroscopic techniques is a compact, informative summary of the most commonly used methods (XPS, IR, EXAFS, and a few others); it includes helpful examples and is a good introduction to the subject. The chapter about temperature-programmed methods is short and informative, and the chapter about determination of surface areas and pore size distributions is too short to provide much perspective. The concluding chapter on future trends in catalysis has a number of timely sugges-

tions, which are written *ex cathedra* and do not succeed in capping off the preceding chapters.

This is a readable and largely up-to-date book and a good entry into much of the catalysis literature. Many valuable references are cited, but the citations are uneven (some results are stated without sources), and much of catalysis is overlooked because of space limitations. The editors' challenging goal of presenting an integrated single-volume statement of homogeneous, heterogeneous, and industrial catalysis has not been met. Rather than veins of ideas, the reader finds isolated nuggets, with even the most obvious potential connections between the chapters missing.

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