

## BOOK REVIEW

**New Developments in Selective Oxidation.** Edited by G. CENTI AND F. TRIFIRÒ. **Studies in Surface Science and Catalysis**, Vol. 55 (B. Delmon and J. T. Yates, Jr., Series Eds.). Elsevier, Amsterdam, 1990. xii + 892 pp. \$197.50.

This book is a collection of the 92 papers presented at the International Symposium on New Developments in Selective Oxidation held in Rimini, Italy, in September 1989. The objective of the symposium was to address new developments in both fundamental research and the industrial applications of selective oxidation. Selective oxidation is of immense importance industrially, both for the synthesis of fine chemicals by controlled liquid-phase oxidation processes and also in the manufacture of a number of high tonnage petrochemical intermediates using heterogeneous catalysts. The subject matter is, therefore, of immense interest to a wide range of scientists.

The book is divided into five main areas. The first section is entitled "Prospectives in Selective Liquid-Phase Oxidation with  $H_2O_2$  and  $O_2$ ," which comprises 23 papers. The introductory review by R. A. Sheldon on "Catalytic Oxidations in the Manufacture of Fine Chemicals" provides useful background to this topic, particularly with respect to recent innovations concerning phase transfer catalysts, metal-substituted zeolites, and the use of heteropolyanions as catalysts. This section of the book deals with a wide range of reactions utilising relatively inexpensive oxidants. Of particular interest is the work of P. Roffia, G. Leofanti, A. Cesana, M. Mantegazza, M. Padovan, G. Petrini, S. Tonti, and P. Gervasutti entitled "Cyclohexanone Ammoxidation: A Breakthrough in the 6-Caprolactam Production Process," which describes the synthesis of cyclohexanonoxime with >99% selectivity by reacting cyclohexanone/ $H_2O_2$ / $NH_3$  over a titanium silicalite catalyst. In addition, K. Sasaki, S. Ito, and A. Kunai describe a new process for the "Direct Conversion of Benzene to Phenols under Ambient Conditions" using a silica-supported Pd-Cu catalyst, which is an interesting approach to a previously well studied subject.

The second section concerns "Non-Traditional Approaches to Reactions of Heterogeneous Selective Oxidation" and contains 11 research papers. The use of nitric oxide as a reactant is described in 2 complementary papers by G. M. Pajonk ("Catalytic Nitroxidation of Aliphatic and Aromatic Hydrocarbons by  $NO$ ") and V. M. Belousov and S. B. Grinenko ("Selective Oxidation of Hydrocarbons by Nitric Oxide to Nitriles"), and this appears to provide a novel route for the introduction of nitrogen for the preparation of chemical intermediates.

"Advances in  $C_2$ - $C_5$  Alkane Selective Transformations" is the subject of the third section made up of 31 papers, including 15 presentations on the topic of methane oxidation, a subject much in vogue at present, and 9 papers on  $C_4$  oxidation to maleic anhydride, a traditional subject for the study of alkane oxidation. Two of the remaining papers address the difficult reaction of propane ammoxidation, a subject worthy of study, in view of the economic importance of acrylonitrile. Y. Ch. Kim, W. Ueda, and Y. Moro-oka describe the use of Ag-doped bismuth vanadomolybdate catalysts and G. Centi, R. K. Grasselli, E. Patanè, and F. Trifirò exemplify the use of vanadium antimonate mixed oxide catalysts for this reaction.

The fourth section is the shortest, comprising 6 papers on the topic of "Electro- and Photo-Oxidation," whereas the fifth section provides 21 papers concerning "New Aspects of the Mechanism and Surface Reactivity of Selective Oxidation Catalysts." It should be noted that the considerable progress made concerning the detailed mechanisms of the oxidation of alkanes and alkenes over both metal and oxide catalysts provides the major part of any taught course in catalysis on the topic of reaction mechanism. In this respect, it is not surprising that 5 papers deal with further details of ethene epoxidation over silver catalysts and 4 papers deal with molybdate catalysts. The new technique of the TAP reactor is exemplified by N. C. Rigas, J. T. Gleaves, and P. L. Mills for the characterisation of oxygen adspecies in the ethene epoxidation reaction. A paper by M. Witko, J. Haber, and E. Broclawik describes "Mutual Oxidation of Oxygen and Hydrocarbon Molecules as a Factor Determining the Reaction Pathway" and demonstrates the growing importance of theoretical studies with respect to catalytic studies in general.

Overall, this collection of papers provides a comprehensive treatment of the recent advances in the wide field of selective oxidation chemistry. The scope of this subject is immense and the wide range of papers covers both traditional reactions as well as the new emerging reactions of importance.

The book is therefore of interest to the catalytic community as a whole, as well as those seeking information and data for reactions currently under active research.

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