

BOOK REVIEW

Selective Oxidation of Hydrocarbons. By D. J. HUCKNALL. Academic Press, London, 1974. vii + 212 pp. \$14.00.

This book deals with the catalytic selective oxidation of C_2 to C_5 aliphatic hydrocarbons, particularly the olefins. The literature reviewed was published mostly between 1965 and 1972 with references to review articles for earlier work. After a very brief introductory chapter on the general physical and chemical aspects of catalysis, the rest of the book is divided into five chapters, four of which cover the selective oxidation of the hydrocarbons, and the last one on the basic mechanism of catalysis in general. The chemical processes selected for this book are almost exclusively those of industrial importance, perhaps because the greatest effort of research on selective oxidation has been devoted to this area. The major subjects are: ethylene to ethylene oxide, acetaldehyde and acetic acid (Chapter 2); propylene to acrolein, acrylic acid, acrylonitrile, acetone and hexadiene (Chapter 3); C_4 -hydrocarbons to butadienes, maleic anhydride, methacrolein and methacrylonitrile (Chapter 4); and C_5 -hydrocarbons to isoprene and other isomerized or oxygenated compounds. For each process, there is a general description of the process and a table listing the pertinent commercial patents with information on the catalyst compositions, process conditions and yields. Then under the subtitle of each major type of catalyst used, a relatively detailed presentation on the kinetics and reaction mechanism is given. It is to these mechanistic discussions that the author has devoted his major effort. Despite the complex and controversial nature of these reactions, the author has succeeded admirably in collating the various results into a manageable form with relatively little inconsistency.

In the last chapter, the author broadens the scope of the book to include some basic theories on the

mechanism of catalysis. In contrast to the comprehensiveness of the preceding chapters, the coverage of this chapter is rather limited. The topics included are: the multiplet theory, taken mainly from the works of Balandin and other Russian sources; the electronic theory, based on the works of Wolkenstein; the crystal and ligand model, attributed to Dowden and Wells; and the empirical correlation between the catalytic activity for complete oxidation or dehydrogenation of hydrocarbons with some physical properties of the oxide catalysts. Unfortunately, the applications of these theories and correlations have been mostly confined to reaction/catalyst systems much simpler and more defined than those for the selective oxidation of the hydrocarbons.

The book is well organized and well written. The utilization of chemical reaction diagrams and tables gives a clear presentation of the often very complex subject matter. The inclusion of the Chemical Abstract reference with the original foreign journal in many instances should be of great help to the readers.

The over 700 references quoted indicate the tremendous effort made on these subjects during the 7 years covered by the book. But it is evident throughout the book that we are still a long way from understanding these reactions and the catalysis mechanism in general. This book gives the reader an organized view of the present status of these industrially important processes. It will be a valuable reference for researchers interested in the reaction mechanisms as well as those seeking practical catalyst formulation.

Y. F. YU YAO

*Scientific Research Staff
Ford Motor Company
Dearborn, Michigan 48121*