

provides general PAH reactions. Many of the novel and convenient synthetic methods and reactions were developed in the author's laboratory over more than three decades, with timeless dedication. This first section provides knowledge on PAH chemistry that can serve as a useful, valuable, and convenient source for those wanting to learn PAH chemistry.

The second section comprises the remaining seven chapters. A total of 125 alternant PAHs with five, six, and seven rings is described in Chapters 5, 6, and 7, and 233 nonalternant PAHs with four, five, six, and seven fused rings are given in Chapters 8, 9, 10, and 11. These chapters provide essential information on each compound as to its sources from organic synthesis, methods of synthesis, physical, structural, and spectral properties, organic reactions, and references of information. Emphasis is placed on the provision of newest synthetic methods. In this section, a total of 511 pages is used to describe 358 PAHs. With less than 1½ pages per compound, the information is presented in a highly condensed manner, and consequently, little in-depth discussion is presented. Furthermore, even though an extensive range of PAHs is covered, some useful information has been omitted, such as the PAH chemistry associated with fullerenes, which represent a new field linking theoretical interest and the application to superconductivity.

The author has previously published a book entitled *Polycyclic Aromatic Hydrocarbons: Chemistry and Carcinogenicity* in 1991, in which the chemistry and carcinogenesis of 49 PAHs are described. To avoid repetition and keep the book size manageable, the chemistry of most of these 49 PAHs is not included in the book under review. Thus, for those who want to obtain the whole scope of PAH chemistry, purchase of both books is recommended.

This book is the most complete account of the chemistry of PAHs currently available, written by a person who has made outstanding contributions to the field during the last several decades. The information described should make this book a valuable addition for research libraries and those interested in PAHs and related fields. I highly recommend this book as an important resource on the chemistry of PAHs, chemical carcinogenesis, environmental pollution, and coal and petroleum science.

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### **Catalysis by Di- and Polynuclear Metal Cluster Complexes.**

Edited by Richard D. Adams (University of South Carolina) and F. Albert Cotton (Texas A&M University). Wiley-VCH: New York, 1998. x + 555 pp. \$125.00. ISBN 0-471-23930-5.

In some ways this book is a successor to an earlier volume in the series, *The Chemistry of Metal Cluster Complexes* (1990). Important new developments in cluster chemistry since that time are discussed here; a large fraction of the references cited are from 1991 or later. However, the chapters also add a great deal of new information concerning applications to catalysis.

Chapter 1 (E. Rosenberg and R. M. Laine) introduces the subject, and outlines criteria for distinguishing homogeneous from heterogeneous catalysis and for establishing cluster catalysis. This chapter also ties in well with a number of the other chapters in the book. Chapter 2 (G. Lavigne and B. de Bonneval) deals with activation of Ru clusters for catalysis, including photochemical methods, use of labile metal-metal and metal-ligand bonds, promoters, and synergism with other metals. Chapter 3 (L. H. Pignolet) emphasizes the reactivity of Au and Au-Pt phosphine clusters toward H<sub>2</sub> for the purposes of H/D exchange and hydrogenation, and heterogeneous catalysts prepared by adsorbing the clusters on solid supports. In Chapter 4 (M. Rakowski DuBois), catalytic reactions of sulfido-bridged molybdenum dimers are discussed: hydrogenation, hydrogenolysis, and olefin oligomerization, with analogies to known heterogeneous metal sulfide catalysts and to sulfur-containing metalloenzymes. Systems with multiple metal-metal bonds can also be catalysts or catalyst precursors, as illustrated in Chapter 5 (M. McCann). The applications include homogeneous reactions and reactions of the complexes after adsorption onto solid supports. Chapter 6 (G. Süß-Fink and M. Jahnke) is an extensive survey of organic syntheses using metal clusters as catalysts, a sort of "minicourse" in organic chemistry with an inorganic perspective. Chapter 7 (M. P. Doyle) deals with binuclear Rh(II)-based catalysts, covering carbene and heteroatom reactions as well as enantioselective processes. Chapter 8 (R. D. Adams) focuses on the activation of strained cyclic sulfur compounds by metal clusters, including the unusual macrocyclization of thietane to generate crown thioethers. In Chapter 9 (I. Ojima and Z. Li) the emphasis is on reactions catalyzed by multinuclear group 9 (Co, Rh, Ir) complexes, mainly addition of Si compounds to C≡C bonds. Chapter 10 (G. G. Stanley), on hydroformylation using a dirhodium-tetraphosphine catalyst, includes mechanistic information deduced from chemical and spectroscopic evidence, and the use of the catalyst for asymmetric hydroformylation. Chapter 11 (L. N. Lewis) examines catalytic applications of colloids, ranging from photoinduced reactions on semiconductors to hydrogenation to oxidation. Chapter 12 (I. I. Moiseev and M. N. Vargaftik) surveys the catalytic properties of Pd clusters, including the "giant clusters" with ca. 570 Pd atoms as well as several mixed-metal catalysts. Chapter 13 (P. Braunstein and J. Rosé) emphasizes the preparation of heterogeneous catalysts from mixed-metal precursors; an extensive table of catalyst composition and reactivity is included. Chapter 14 (B. C. Gates) also treats supported cluster catalysts, with insights from spectroscopy and electronic structure into chemical properties and catalytic activity.

This book presents a wide variety of perspectives on what is a highly interdisciplinary field, catalysis by metal cluster compounds. It is a must for libraries, and students and practitioners interested in any aspect of catalysis, from organic synthesis through inorganic/organometallic mechanisms to surface chemistry, will also find it valuable.

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