

Book review

Metal Clusters in Catalysis, edited B.C. Gates, L. Guzzi and H. Knözinger, (Studies in Surface Science and Catalysis, Vol. 29), Elsevier Science Publishers, 1986, xxvii + 648 pages, US\$ 84.75, ISBN 0-444-42708-2.

The collection of reviews in this volume provides an up-to-date account of research on metal clusters in catalysis. The first section, dealing with molecular metal clusters, will probably be the most obviously interesting to most organometallic chemists. Successive chapters deal with syntheses of homometallic and multi-metallic clusters, structures of metal clusters, thermochemical properties and bond energies of transition metal clusters, cluster reactivity and homogeneous catalysis by metal clusters. The first three chapters are brief and illustrative, rather than comprehensive. The literature references in these sections are not extensive and a novice in the area would need the help of earlier reviews to get started. Cluster reactivity and homogeneous catalysis are more extensively treated and well referenced into 1984.

The second part of the book, and much the longest, considers metal clusters in and on supports. The emphasis is on species with structures analogous to those of molecular species. Supports range from polymers and zeolites to metal oxides, and provide varying degrees of direct ligation for the clusters. The first section deals with characterisation by physical methods including vibrational spectroscopy, UV-visible spectroscopy, magnetic resonance techniques, photoelectron spectroscopy, Mössbauer spectroscopy, X-ray absorption spectroscopy and thermoanalytical methods. This is a thorough and comprehensive account, with many examples and references. The next chapter deals with a more novel topic, the synthesis of dispersed metal clusters from metal vapour chemistry, which will doubtless develop considerably in the next few years. Again the physical techniques for the characterisation of clusters formed by this route are well considered. Metal aggregates are not the primary focus of this work, but the editors rightly consider this area to be too exciting to ignore. Chapter 8 reviews metal clusters in zeolites, in which such species figure prominently, highlighting the necessarily interdisciplinary nature of this field. This theme is continued in Chapter 9, which considers supported metal catalysts prepared from molecular metal clusters on both polymeric and metal oxide supports. The surface chemistry of the organometallic species is well illustrated and the discussion is supported by extensive tables. The reactivities of such systems for alkene isomerisation and hydroformylation, skeletal rearrangement of hydrocarbons and the Fischer Tropsch process are reviewed. The section concludes with a discussion of bimetallic catalysts derived from molecular metal clusters. Part III of the volume is a single chapter addressing the relationship between metal clusters and metal surfaces, which has for many years been cited as the justification for the pursuit of cluster chemistry. At the junction of organometallic chemistry and surface

science this claim is now becoming a reality. A conclusion, written by the editors, summarises the present position and assesses the potential for the future.

The book is provided with a subject index, which is a little sparse, and a cluster index which is excellent. The production appears to be camera-ready, but is still very readable and has no more than the usual number of typographic errors. Most of the chapters review the literature into 1984, but a few seem more dated, which is a pity in this rapidly changing field.

Cluster chemistry was early predicted to be a new and excellent source for catalytic systems. This prediction has not been fully realised and the systems in which an intact molecular cluster (rather than an unidentified species formed by cluster fragmentation) has been proven to act as a homogeneous catalyst are still relatively few. However, clusters are compelling models of small metal particles, and metal clusters anchored to surfaces are among the best characterised of known supported metal catalysts. This work brings together specialists in organometallic chemistry, surface science and catalysis, and may be thoroughly recommended to workers in these fields. In North America it may be obtained from Elsevier Science Publishers Co. Inc., P.O. Box 1663, Grand Central Station, New York, NY 10163.

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