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Journal of Molecular Catalysis A: Chemical 114 (1996) 1

JOURNAL OF MOLECULAR CATALYSIS A: CHEMICAL

Foreword: Polyoxometalates in catalysis

The large and rapidly growing class of inorganic compounds known as early-transition-metal–oxygen–anion clusters, or polyoxometalates for convenience, have garnered considerable recent attention in catalysis, medicine, and various technologies as they are generally accessible, inexpensive, and unusually versatile. There are two generic classes of polyoxometalates, the isopolyoxometalates or isopoly compounds, that contain only the principal (skeletal) transition metal cations and oxide ions, and the heteropolyoxometalates or heteropoly compounds, that contain cation(s), referred to as 'heteroatom(s)', in addition to the principal skeletal transition metal cations. Most of the elements in the p and d blocks of the periodic table have been documented as heteroatoms in heteropoly compounds. One large subset of heteropoly compounds are the heteropolyacids which are of considerable significance in catalysis, both as acids and as redox agents.

The extraordinary versatility of polyoxometalates derives from the fact that a host of molecular properties, including virtually all those that affect catalysis, such as redox potential, pH range of hydrolytic stability, charge and charge density, polarity, shape (chirality in some instances), solubility, etc., can be synthetically controlled. The number of molecular compositions available for common polyoxometalate structural families, such as the Keggin heteropoly compounds, number in the hundreds if not thousands at parity of cation. Furthermore, a myriad of cations themselves can be used for these or most polyoxometalates.

Polyoxometalates are the subject of ongoing fundamental investigations in both homogeneous and heterogeneous catalysis. In addition, several polyoxometalate based systems have proceeded to commercial use in the last few years. We have endeavored in this volume to bring together a number of papers that exhibit and the richness as well as the depth of ongoing research in polyoxometalate catalysis. This issue should provide an overview of the entire research enterprise and function as a reference resource to some extent as well. The first 25 or so papers address primarily homogeneous systems and the last 10 or so address primarily heterogeneous systems. There are contributed papers in both areas that don't fall neatly into either conventionally defined category, however. We trust this volume will prove to be of some value of polyoxometalate and/or catalysis experts and neophytes alike.

I would like to thank Dr. Christina McCartha and Dr. Robin Gall for assistance with technical editing and general administration associated with production of this volume.

Craig L. Hill
Atlanta, GA, USA
July, 1996

1381-1169/96/$15.00 Published by Elsevier Science B.V.
PII S1381-1169(96)00338-X