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Preface

Homogeneous catalysis using transition metal complexes became recognizable as a discipline during the late 1950s and 1960s, and has grown at an enormous rate, particularly in the last two decades, becoming increasingly important to organic chemists and industrial chemists, as well as academics. As an inorganic chemist, thanks to my doctorate advisor at Oxford, Bob (RJP) Williams, I was fortunate to survive drowning in the solution chemistry of copper and iron phenanthrolines and dipyridyls, which were (so Bob told me!) early models for cytochromes of relevance in redox chemistry including catalytic oxidations. I was subsequently equally fortunate to be a postdoctoral fellow here in Vancouver with Jack Halpern, certainly a pioneer in the general homogeneous catalysis area, and particularly in hydrogenation. My own academic career, formulated on these experiences, began in 1964, and thus I have essentially "grown up" with the homogeneous catalysis literature (much easier than having to read decades of older literature!). I guess every research scientist has such an experience; current 'hot' topics for inorganic/organometallic chemists are 'material science' and 'nanoscience', but I was lucky in that homogeneous catalysis really was my area of choice, and has been for the last 40 years. I was thus delighted to be asked by Barry Lever, Editor of this journal, to organize a volume in this area. I approached about 35 prospective authors, some seasoned like myself, others younger, all keen to promote homogeneous catalysis. Some were already "reviewed out", others (like myself) missed the deadline, despite several extensions; however, 19 contributions were finally accepted, and a wide range of topics is covered.

It is 37 years since the first reports on asymmetric catalysis appeared (initially in hydrogenation, and then later in isomerization, various oxidations and hydroxylations, hydroformylation, hydrocyanation, hydrosilylation, olefin polymerization and metathesis, cyclopropanation, C−C bond coupling such as allylic alkylation, etc.), and this area has really exploded with developments in pharmaceuticals, agrochemicals, the perfume industry, and the petrochemical industry. Mechanistic understanding continues to evolve, and this will lead to further improved catalysts. Articles from the groups of Claudio Bianchini, Albert Chan, Carmen Claver, Philippe Kalck, and Bob Morris present examples of various stereoselective syntheses. Chiral phosphine ligand systems remain dominant, while increasing use of nucleophilic N-heterocyclic carbene ligands, sometimes within the now so-called pincer ligands, to replace phosphine ligands continues unabated, and this is exemplified by papers from Bob Crabtree's and Cathy Crudden's groups. Application of some pincer ligands within palladium systems is described in the review by Gerard van Koten and coworkers. Aspects of carbon-carbon and carbon-heteroatom coupling reactions are discussed in contributions from Robin Bedford's group, Fred Noels and coworkers, and Irina Beletskaya and Andrei Cheprakov. Carbon-carbon bond formation is exemplified also by some polymerization reactions described by André Mortreux and his colleagues [1], and further elaborations on these, metathesis, ROMP and various tandem catalytic processes are discussed by Deryn Fogg and Eduardo dos Santos. The article by Ilya Moiseev and Michael Vargaftik on allylic oxidations perhaps reminds us of continuing efforts to utilise the cheapest oxidant (dioxygen) for selective oxidations. Contributions from Mike Green, and from Piet van Leeuwen's group elaborate on the use of high pressure IR and NMR techniques for unravelling mechanistic intricacies of hydroformylation, a process also first reported about 40 years ago.

The drawback to commercial applications of homogeneous catalysis remains, of course, the recovery of the catalyst from solution for re-use. There is much current interest in using water as a solvent (for "greener chemistry") by incorporation of water-soluble ligands, but one should recall (and often not acknowledged in recent literature) that the majority of the early homogeneous catalysts of the 1950s and 1960s did indeed operate in purely aqueous media (for example, in many hydrogenations, and in the Wacker process). The subsequent development of organometallic chemistry in non-aqueous solvents led to isolation of intermediates (for example, hydrides), and then a shift of homogeneous catalysis

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to non-aqueous solvent systems. The resurgence in aqueous catalysis has also brought with it renewed interest in a wide range of two-phase systems with various combinations of water, organic solvents, supercritical liquids, and ionic solvents, sometimes these stabilizing effective colloidal catalysts, the grey area between homo- and heterogeneous catalysis. Contributions from Philip Jessop and Ferenc Joó, Paul Dyson, and Tom Welton, reflect such interest.

So, enjoy the reading, and update yourselves in aspects of homogeneous catalysis. For further updating, please consider attending the biennial International Symposium on Homogeneous Catalysis (ISHC). The first one was equated with a symposium held within an American Chemical Society Local Section Meeting in Corpus Christi, Texas, in 1978; organized by Minoru Tsutsui, ISHC-1 attracted over 250 delegates. Since that time, the ISHC meetings have become the major forum for portraying the current status of the science and art of homogeneous catalysis. ISHC-14, held in Munich in July of this year, attracted over 900 delegates, while the average attendance is usually about 500. ISHC-15 will be hosted by Mike Green in Sun City in South Africa from August 20–25, 2006 (following the 37th International Conference on Coordination Chemistry, August 13–18, in Capetown), and ISHC-16 will be hosted by Claudio Bianchini in Florence in Italy from July 6–10, 2008. Hope to see you at future ISHC meetings!

Reference

[1] This paper actually appeared in Coord. Chem. Rev. 248 (2004) 397–410.

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