Aqueous organometallic catalysis. Old wine in a new bottle?

Ferenc Joó
University of Debrecen, Hungary

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During the past 40 years, aqueous organometallic catalysis has developed from curiosity into an established field of catalysis. This development was fueled by ever-changing needs and interests such as a) design of biomimetic catalytic systems, b) recovery and reuse of expensive soluble catalysts in aqueous-organic biphasic reaction mixtures, c) replacement of toxic organic solvents by water as green reaction medium, and d) construction of catalytic systems for reactions of water itself (hydration, telomerization, etc.). In several cases water strongly influences reaction mechanisms through its effects on hydration of polar or ionic reactants and products or by acting as proton transfer relay. These characteristics of aqueous organometallic catalysis will be illustrated by examples discovered in the author's laboratory and by a few cases taken from the literature.

Ferenc JOÓ (Tótkomlós, Hungary, Jan. 06. 1949)

Education and degrees:
Chemistry major, L. Kossuth University, Debrecen, Hungary, 1972.
Ph.D. from the same university, 1995 (supervisor: Prof. M. T. Beck)
Doctor of Science (Hungarian Academy of Sciences) 1991.
Member, Hungarian Academy of Sciences, 2001
Member, Hungarian Academy of Sciences, 2007

Research activity:
Ever been interested in use of organometallic catalysts in aqueous systems. This work started in 1971 with research into the catalytic activity of platinum group metal complexes containing meta monosulfonated triphenylphosphine ligands. This was later extended to study of phase transfer catalyzed organometallic reactions. Applied water soluble catalysts for modification of biological membranes (including live cells) by hydrogenation. Such modifications give information on the mechanism of stress tolerance of the cells. In addition to the above, present interest includes catalytic hydrogenation of carbon dioxide in aqueous solutions, synthesis and catalytic applications of water-soluble N-heterocyclic carbene complexes, and the use of ionic liquids in homogeneous and biphasic catalysis.
Visited several laboratories for various durations in Europe, Canada, US and Israel. Lady Davis Visiting Professor, Department of Organic Chemistry, The Hebrew University, Jerusalem, Israel. Host: Prof. J. Blum, Autumn semester 1993/94. Iberdrola Visiting Professor, Department of Inorganic Chemistry, The University of Zaragoza, Spain. Host: Prof: L. A. Oro, Autumn semester, 1995/96. Visiting Professor, ENSC Toulouse, France. Host: Prof. P. Kalck, June 2001. Visiting Professor, EPFL Lausanne, Switzerland, Host: Prof. P. J. Dyson, May-June, 2003. Co-director (with I. T. Horváth) of a NATO Advanced Research Workshop on Aqueous Organometallic Chemistry and Catalysis (Debrecen, 1994). Member of the International Advisory Board of the International Symposium on Homogeneous Catalysis series. Advisory Board member for "Reaction Kinetics and Catalysis Letters" and "Catalysis Communications". 3 books, 130 res. publications in refereed journals and books, ≥2350 independent lit. citations.

Awards:
Buzágh Award of the Hungarian Academy of Sciences;
"Master Teacher" Award of the National Committee of Technical Development;
Apáczai-Csere Prize, Ministry of Education, Hungary; Széchenyi Prize, The President of the Republic of Hungary;
Alcoa Leo Szilard Prize, Ministry of Culture and Education, Hungary.