Special Seminar: Cross Canadian Catalysis Lecture

Feb 19th, Tuesday, 2:00 pm, Wallberg Building, Room 215

Hydrogenation and Dehydrogenation Kinetics and Catalysis for Hydrogen Storage on Organic Liquids

Kevin J. Smith

Department of Chemical and Biological Engineering and Clean Energy Research Center

University of British Columbia, Vancouver

Development of a hydrogen economy requires efficient hydrogen storage and transport technologies. For automotive applications, high hydrogen storage densities (>5.5 wt %) are also necessary. The use of liquid organic hydrogen carriers (LOHCs) for hydrogen storage has received attention recently because they meet the automotive density demands and they can use existing infrastructure for transport and storage. LOHCs deliver the hydrogen on-board the vehicle by catalytic dehydrogenation whereas the spent LOHC is regenerated by hydrogenation off-board the vehicle. This presentation provides an overview of our recent results on the kinetics and catalysis of heterocycle hydrogenation/dehydrogenation reactions. In particular, we show how structure sensitivity of dodecahydro-N-ethylcarbazole dehydrogenation over Pd catalysts at low temperature (< 200 °C) impacts hydrogen recovery. The importance of including a heteroatom (N) in the polycycle is also demonstrated by comparing the dehydrogenation kinetics of dodecahydrocarbazole and dodecahydrofluorene. Finally, some of the mechanistic and kinetic details of the reactions are discussed, based on a combination of experimental results and DFT calculations.

The Cross-Canada Lecture Series is sponsored by the Canadian Catalysis Foundation (CCF) under the guidance of the Catalysis Division of the Canadian Institute for Chemistry. Every year, the lecture series feature prominent researchers in the field of catalysis, both from Canada and from the rest of the world. The financial support of the CCF covers the travel costs associated with the presentation of these lectures at multiple institutions across the country.

Biography. Kevin J. Smith is Professor of Chemical and Biological Engineering and member of the Clean Energy Research Center at the University of British Columbia. He received his Ph.D. from McMaster University, working with the late Professor Bob Anderson and has > 25 years experience in applied catalysis research. His research is focused on issues related to the Canadian energy scene, with primary interests in C_1-catalysis and upgrading Canadian oilsands. He holds three patents and has published widely in the areas of alcohol synthesis from syngas, methane conversion and the hydroconversion of heavy oils. He is the recipient of the Canadian Catalysis Lectureship Award (2012), the Canadian Council of Professional Engineers Medal for Distinction in Engineering Education (2006) and the APEGBC Teaching Award for Excellence in Engineering and Geoscience (2005). He served as Head of the Department of Chemical and Biological Engineering at UBC from 2001 to 2009 and is past chair of the Catalysis Division of the CIC and the Canadian Catalysis Foundation. He was elected Fellow of the CIC in 2004.

Host: Cathy Y. Chin and Chuck Mims. If you would like to meet with the seminar speaker, Please contact cathy.chin@utoronto.ca