CHEMICAL ENGINEERING
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CHEMICAL ENGINEERING 290 SEMINAR SERIES PRESENTS

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Catalytic deoxygenation and oxidation for sustainable chemistry

4 pm - Tuesday, September 29th 2015 in ENGR II 1519

Critical to bridging the gap between biomass and fossil fuel industrial chemistry will be the synthesis of key petroleum-based chemical intermediates and end-products from biomass feedstock. In this context, the lignin fraction of lignocellulosic biomass represents the most viable source to produce aromatic compounds. The first part of this talk will focus on describing the structure, site evolution, and mechanistic characteristics of self-supporting, high surface area (~100 m2g-1) molybdenum carbide (Mo2C) based catalytic formulations for atmospheric pressure hydrodeoxygenation of lignin-derived polyfunctional molecules to make aromatics and, more generally, to demonstrate the oxophilic characteristics of Mo2C which make it both a selective and tunable catalyst for hydrodeoxygenation.

The second part of this talk will describe the mechanistic origins of over-oxidation and C-C bond scission products in the partial oxidation of propylene to acrolein on mixed metal oxide catalysts. The complexity of multi-component oxidic formulations and the trace quantities (<10% total on a carbon basis) of acetaldehyde, acetic acid, acetone, acrylic acid, ethylene, butadiene, benzene, CO, and CO2 that are formed as by-products have precluded so far a firm mechanistic understanding of structure-function correlations for this chemistry. We illustrate the detailed reaction network for this chemistry and develop a kinetic model that quantitatively describes the formation and consumption of all observed products with the objective of developing improved formulations that minimize unselective oxidation.

Aditya Bhan received his Bachelor of Technology (B. Tech.) in Chemical Engineering from IIT Kanpur in 2000 and his PhD in Chemical Engineering from Purdue University in 2005. From January 2005 to August 2007, Dr. Bhan was a postdoctoral scholar at the University of California at Berkeley. Since September 2007, he has been on the Chemical Engineering and Materials Science faculty at the University of Minnesota. Dr. Bhan leads a research group that focuses on the structural and mechanistic characterization of catalysts useful in energy conversion and petrochemical synthesis. His group at the University of Minnesota has been recognized with the DOE Early Career Award, the NSF Career Award, the McKnight Land Grant Professorship, and the 3M Non-tenured Faculty Award.

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