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Promoting Catalytic Science and Technologies

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Catalysis Club of Philadelphia

Thursday April 16th, 2015
DoubleTree Hotel
4727 Concord Pike Wilmington, DE 19803

The Design of New Catalysts for Biomass Conversion with Atomic Layer Deposition

George W. Huber
Department of Chemical and Biological Engineering
University of Wisconsin
Madison, WI
http://biofuels.che.wisc.edu/

Social Hour: 5:30 PM
Dinner: 6:30 PM
Meeting: 7:30 PM

Members: $35.00
Walk Ins & Non-members: $40.00
Student & Retired Members: $20.00

Menu

Airline Breast of Chicken – with white wine sauce, lump crab imperial and baby vegetables;
Stuffed Black Angus Flank Steak – with mushrooms, broccoli rabe, onions, fire roasted red peppers, provolone cheese and served with garlic mashed potatoes;
Vegetable Lasagna;

Meal reservations - Please notify your company representative or Eyas Mahmoud (eyas@udel.edu) by ***Thursday April 9th*** , or register online: http://catalysisclubphilly.org/program/ meeting-registration/

Company Representatives – We would like to encourage you to make meal/meeting reservations to your company representative.

Membership - Dues for the 2014-15 season will be $25.00 ($5.00 for the local chapter and $20.00 for the national club). Dues for students, post-docs and retirees will be $10.00 ($5.00 for local club and $5.00 for national club).

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Abstract. The objective of the Huber research group is to develop new catalytic processes and catalytic materials for the production of renewable fuels and chemicals from biomass, solar energy, and natural gas resources. We use a wide range of modern chemical engineering tools to design and optimize these clean technologies including: heterogeneous catalysis, kinetic modeling, reaction engineering, spectroscopy, analytical chemistry, nanotechnology, catalyst synthesis, conceptual process design, and theoretical chemistry. In this presentation we will first discuss the hydrodeoxygenation of biomass into different fuels and chemicals. In addition we can use HDO to easily produce new classes molecules that are not currently produced from petroleum feedstocks. Hydrodeoxygenation (HDO) is a platform technology used to convert liquid biomass feedstocks (including aqueous carbohydrates, pyrolysis oils, and aqueous enzymatic products) into alkanes, alcohols and polyols. In this process the biomass feed reacts with hydrogen to produce water and a deoxygenated product using a bifunctional catalyst that contains both metal and acid sites. The challenge with HDO is to selectively produce targeted products that can be used as fuel blendstocks or chemicals and to decrease the hydrogen consumption. We will discuss how different biomass based feedstocks can be converted into fuels or chemicals by HDO. We will outline the fundamental catalytic chemistry and the scientific challenges. We will then discuss how ALD can be used to design improved catalytic materials.
Atomic layer deposition (ALD) has emerged as a tool for the atomically precise design and synthesis of catalytic materials. We discuss examples where the atomic precision has been used to elucidate reaction mechanisms and catalyst structure-property

relationships by creating materials with a controlled distribution of size, composition, and active site. We highlight ways ALD has been utilized to design catalysts with improved activity, selectivity, and stability under a variety of conditions (e.g., high temperature, gas- and liquid-phase, and corrosive environments). In addition, due to the flexibility and control of structure and composition, ALD can create myriad catalytic structures (e.g., high surface area oxides, metal nanoparticles, bimetallic nanoparticles, bifunctional catalysts, controlled micro-environments, etc.) that consequently possess applicability for a wide-ranging number of chemical reactions (e.g., CO2 conversion, electrocatalysis, photocatalytic and thermal water splitting, methane conversion, ethane and propane dehydrogenation, and biomass conversion). Finally, the outlook for ALD-derived catalytic materials is discussed with emphasis on the pending challenges as well as areas of significant potential for building scientific insight and achieving practical impacts.

Speaker Bio. George W. Huber is a Professor of Chemical Engineering at University of Wisconsin-Madison. His research focus is on developing new catalytic processes for the production of renewable liquid fuels and chemicals.
George is one of the most highly cited young scholars in the chemical sciences being cited over 3,200 times in 2014 and over 14,000 times in his career. He has authored over 100 peer-reviewed publications including three publications in Science. Patents and technologies he has helped develop have been licensed by three different companies. He has received several awards including the NSF CAREER award, the Dreyfus Teacher-Scholar award, fellow of the Royal Society of Chemistry, and the outstanding young faculty award (2010) by the college of engineering at UMass-Amherst. He has been named one of the top 100 people in bioenergy by Biofuels Digest for the past 3 years. He is co-founder of Anellotech a biochemical company focused on commercializing, catalytic fast pyrolysis, a technology to produce renewable aromatics from biomass. George serves on the editorial board of Energy and Environmental Science, ChemCatChem, and The Catalyst Review. In June 2007, he chaired a NSF and DOE funded workshop entitled: Breaking the Chemical and Engineering Barriers to Lignocellulosic Biofuels (www.ecs.umass.edu/biofuels).

George did a post-doctoral stay with Avelino Corma at the Technical Chemical Institute at the Polytechnical University of Valencia, Spain (UPV-CSIC) where he studied bio-fuels production using petroleum refining technologies. He obtained his Ph.D. in Chemical Engineering from University of Wisconsin-Madison (2005). He obtained his B.S. (1999) and M.S.(2000) degrees in Chemical Engineering from Brigham Young University.