Catalysis Club of Philadelphia

Thursday September 19th, 2013
DoubleTree Hotel
4727 Concord Pike Wilmington, DE 19803

Kinetics and Mechanisms of C-C Forming and C-O Cleavage Reactions of Interests in Bio-oil Upgrading

Daniel E. Resasco
University of Oklahoma, Norman, OK

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

Pesto Roasted Chicken Breast - sun-dried tomato risotto and sautéed broccolini;

Blackened Shrimp & Diver Scallops -crispy chive and cheddar polenta, sautéed spinach with chorizo and a creole cream sauce;

Vegetable Filo Triangle - roasted red pepper hummus, sun-dried tomatoes, black eyed peas, broccoli, okra, lime and garlic wrapped in filo dough.

Meal reservations - Please notify your company representative or Jacob Weiner (jlweiner@udel.edu, phone: 302.831.2213) by ***Thursday September 12th***.

We also encourage you to make the meal reservations online at: http://catalysisclubphilly.org/program/meeting-registration/

Membership - Dues for the 2012-13 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:

Bio-oil produced by fast pyrolysis of lignocellulosic biomass has attracted considerable attention as an intermediate liquid product towards the production of fuels. However its chemical instability, high viscosity, and corrosiveness limit their processability and storage. One of the greatest challenges in the upgrading of bio-oil is the accelerated degradation that occurs when the condensed liquid is subsequently heated for fractionation or other processing. Catalytic upgrading is an attractive strategy that can be used to optimize carbon efficiency and minimize hydrogen usage. Important reactions for this upgrading include:

(a) formation of C-C bonds to extend the carbon backbone of short oxygenates to the desired gasoline/diesel range via aldol condensation and ketonization in aqueous phase

(b) incorporation of short carbon fragments (C_1-C_3) into the aromatic ring of phenolic compounds via alkylation in biphasic systems;

(c) deoxygenation of the resulting products to monofunctional compounds or hydrocarbons in the liquid phase.

We have investigated the kinetics and reaction mechanisms of these reactions on different catalysts, including metals supported on reducible oxides (e.g. Ru/TiO_2); acidic catalysts (HY, H-beta zeolites), supported metal catalysts (Cu, Ni, Ru, Pd supported on carbon nanotubes) and amphiphilic nanoparticle catalysts that are able stabilize water/oil emulsions and to conduct reactions at the liquid/liquid interface to benefit from the differences in solubility exhibited by the reactants (bio-oil) and products (bio-fuels) and achieve continuous reaction/separation.

References:

- "Improving carbon retention in biomass conversion by alkylation …" Appl. Catal. A 447, 14, 2012
- "Aqueous Phase Ketonization of Acetic Acid over Ru/TiO_2/Carbon Catalysts" J. Catal. 295, 169, 2012
- "Hydrophobic zeolites for biofuel upgrading at the liquid-liquid interface … JACS134, 8570, 2012
- "What Should We Demand from the Catalysts Responsible for Upgrading Biomass?" J. Phys. Chem. Lett., 2, 2294, 2011
- "Selective Conversion of Furfural to Methylfuran over Ni-Fe Catalysts," J. Catal. 284, 90, 2011
- "Bifunctional transalkylation and hydrodeoxygenation of anisole over Pt/HBeta," J. Catal. 281, 21, 2011
- "Conversion of furfural and 2-methylpentanal on Pd–Cu catalysts" J. Catal. 280, 17, 2011

- “Kinetics and mechanism of hydrogenation of furfural on Cu catalysts,” J. Catal. 277, 1, 2011
- “Role of transalkylation in the conversion of anisole over HZSM-5,” Appl. Catal. A, 379, 172, 2010
- “Solid Nanoparticles that Catalyze Biofuel Upgrade at the Water-Oil Interface, ” Science, 327, 68, 2010

Speaker Bio:

Daniel E. Resasco is a Professor of Chemical, Biological, and Materials Engineering at the University of Oklahoma. He holds the D. Bourne endowed Chair. He received his PhD from Yale University in 1983. He is author of more than 200 publications and 35 industrial patents in the areas of heterogeneous catalysis and carbon nanotubes and has received more than 8,000 citations. He has been a Presidential Professor, S. Wilson Professor, and in the last few years he was awarded the Oklahoma Chemist of the Year award by the American Chemical Society, the Yale Science and Engineering Association award, and the Regents Award for Superior Research. He is the founder of SouthWest Nanotechnologies, a commercial carbon nanotube producer that operates in Norman, OK. He has been Editor of the Journal of Catalysis, and has been a member of the editorial board of Applied Catalysis and Journal of Catalysis.