Promoting Catalytic Science and Technologies

Catalysis Club of Philadelphia

Thursday September 18th, 2014
DoubleTree Hotel
4727 Concord Pike Wilmington, DE 19803

Challenges and Solutions in Developing Zeolite Supported Transition Metal Catalysts for Lean-Burn NOx Emission Control

Hai-Ying Chen
Emission Control Technologies, Johnson Matthey Inc., Wayne, PA

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

Seared Yellow Fin Tuna – cucumber wasabi-teriyaki glaze, sautéed spinach with jasmine rice;

Rosemary Dijon Chicken – sautéed chicken breast with roasted cherry tomatoes and a rosemary Dijon cream sauce served with her roasted potatoes and fresh green beans;

Grilled Vegetable Ravioli – grilled vegetables blended with ricotta, mozzarella, parmesan, fontina & pecorino romano cheese wrapped in basil pasta;

Meal reservations - Please notify your company representative or Eyas Mahmoud (eyas@udel.edu) by ***Thursday September 11th***, 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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chenh@jmusa.com

Abstract:

Reduction of NOx emissions from lean-burn engine exhaust has been a main topic of environmental catalysis in the past 20 years. The challenge is the selective conversion of a low concentration of NOx (~100 ppm) in the presence of large excess of O_2 (~10%). Although zeolite supported transition metal catalysts were identified in early 1990s as promising catalysts, such a technology was not implemented till recently.

Early Studies mainly focused on the development of zeolite supported transition metal, primarily Cu and Fe, catalysts for the selective catalytic reduction of NOx with hydrocarbons (HC-SCR). Even though the HC-SCR technology has been considered as the "holy grail" of automotive catalysis, technical challenges on the activity, selective and durability of the catalysts were recognized to be difficult to overcome for the technology to be implemented into real world applications. However, the vast amount of research work, especially the fundamental studies on the reaction and the catalyst deactivation mechanisms, demonstrated that the activity and selectivity of this type of catalysts can be drastically improved if an alternative reductant, NH_3, is available in the feed.

Extensive investigations on the selective catalytic reduction of NOx with NH_3 (NH_3-SCR) began in the middle 2000s aimed to enable diesel powered vehicles to meet the US EPA 2007/2010 emission regulations. Both Cu and Fe catalysts were considered. Zeolite supported Cu SCR catalysts are more active at low temperature, thus more attractive for applications with low exhaust temperature. The conventional medium-pore zeolite (10-ring, such as ZSM-5) or large-pore zeolite (12-ring, such as beta) supported Cu catalysts, however, cannot meet the long-term durability requirements. To overcome this major technical hurdle, small-pore zeolite (8-ring) supported Cu catalysts were invented. On the other hand, zeolite supported Fe SCR catalysts are more selective in utilizing NH_3 for NOx reduction at high temperatures but show a strong dependence on the NO to NO_2 ratio in the feed gas at low temperatures. System

approaches were developed to enhance the low temperature SCR activity of the Fe SCR catalysts. As such, both Cu and Fe SCR catalysts were successfully commercialized and applied on lean-burn diesel vehicles meeting the stringent US EPA 2010 emission standards.

Speaker Bio:

Dr. Hai-Ying Chen is a Scientific and Product Development Manager at Johnson Matthey, where he leads a team of scientists to develop advanced emission control catalysts and technologies for both gasoline engine and diesel engine powered vehicles to meet the government emission regulations.

Dr. Chen received his Ph.D. in Chemistry from Fudan University, China. He has published more than 50 technical papers in peer-reviewed journals and holds 14 US/international patents. He received the Top Cited Article Award by Catalysis Today for articles published in 1998, and was a recipient of the American Chemical Society Award for Team Innovation in 2009. He was named as the 2014 Herman Pines Award in Catalysis by the Chicago Catalysis Club and the 2014 Catalysis Club of Philadelphia Award by the Catalysis Club of Philadelphia.