

CATALYSIS CLUB OF PHILADELPHIA

*Promoting Catalytic
Science and Technologies*

SPONSORS

GOLD
AIR PRODUCTS
ARKEMA
JOHNSON MATTHEY
PQ/ZEOLYST

SILVER
INTERTEK
LYONDELLBASELL

CHAIR
Joe Fedeyko
Johnson Matthey

CHAIR-ELECT
Bjorn Moden
Zeolyst International

PAST CHAIR
Dionisios Vlachos
University of Delaware

TREASURER
Stephen H. Harris
LyondellBasell Industries

SECRETARY
Parag Shah
PQ Corp.

PROGRAM CHAIR
Carl Menning
DuPont

ARRANGEMENTS CHAIR
Kevin Bakhmutsky
University of Pennsylvania

DIRECTOR, SPONSORSHIP
Charles Coe
Villanova University

DIRECTOR, STUDENT POSTER
Michael Smith
Villanova University

DIRECTOR, Membership
Agnes Kovacs
Air Products

DIRECTOR
Ivan Baldychev

WEBMASTER
Edrick Morales
LyondellBasell Industries

NATIONAL REPRESENTATIVE
Anne Gaffney
INVISTA

Catalysis Club of Philadelphia

Thursday November 17th, 2011

DoubleTree Hotel
4727 Concord Pike Wilmington, DE 19803

**Solid Oxide Fuel Cells - Moving to Proton Conduction
and Material Insights by Neutron Diffraction**

Steven McIntosh

Department of Chemical Engineering, Lehigh University
&

Graduate Student Poster Competition

Note: The Poster Session starts at 5 PM

Posters & Social Hour: 5:00 PM

Buffet Dinner: 6:30 PM

Meeting: 7:30 PM

Members: \$35.00

Walk Ins & Non-members: \$40.00

Student & Retired Members: \$20.00

Menu

Buffet (except vegetarian/vegan)

Chicken Osso Buco Roasted with
Mint Pomodora and served with
Cous Cous

Carved Flat Iron Steak Marinated
twenty four hours & grilled with
Mushrooms & Onions with Garlic
Whipped Potatoes

Classic Caesar Salad

Selected Meals:

Vegetarian: Eggplant Rollatini rolled
and stuffed with sautéed vegetables
then topped with a Melted
Mozzarella & Balsamic Glaze

Vegan: Mediterranean Purse
Roasted Vegetables, Couscous,
served with Ratatouille.

Meal reservations - Please notify
your company representative or
Kevin Bakhmutsky
(kbakh@seas.upenn.edu, phone:
215.898.0056, fax: 215.573.2093)
by **Thursday November 10th**.

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

Membership - Dues for the 2011-12
season will be \$25.00 (\$5.00 for the
local chapter and \$20.00 for the
national club). Dues for students
and post-docs will be \$10.00 (\$5.00
for local club and \$5.00 for national
club). Please send your payment to
Steve Harris, LyondellBasell
Industries 3801 West Chester Pike,
Newtown Square, PA 19073.

Catalysis Club of Philadelphia

Thursday November 17th, 2011

DoubleTree Hotel

4727 Concord Pike Wilmington, DE 19803

Solid Oxide Fuel Cells - Moving to Proton Conduction and Material Insights by Neutron Diffraction

Steven McIntosh

Department of Chemical Engineering, Lehigh University, mcintosh@lehigh.edu

Abstract:

The promise of direct and efficient conversion of chemical to electrical energy makes fuel cell development an area of great technological interest. Solid Oxide Fuel Cells (SOFCs) are one of the most promising technologies to meet this goal. However, current SOFCs operate at temperatures above 700°C. This high temperature increases costs and decreases cell lifetime. One approach to overcoming this challenge is to develop new lower temperature electrolyte materials. To this end we have been developing intermediate temperature ceramic proton conductors through selective doping of barium cerates and zirconates. The resulting SOFCs have been demonstrated to operate with hydrogen fuel and via internal steam reforming of lower alcohols. These cells may also find application as reversible fuel cells/electrolysis cells for large scale energy storage as part of the future smart grid.

Another avenue of exploration has been to develop deeper understanding of the air electrode (cathode) materials for traditional SOFCs. The SOFC electrode requires high surface electrocatalytic activity coupled to high bulk ion and electron transport rates. We have developed an *n-situ* neutron diffraction sample environment in order to study oxygen anion motion in these materials under realistic SOFC operating conditions. This enables determination of preferred ionic transport pathways and the concentration of free ionic carriers. These unique insights enhance our understanding of current materials and enable targeted design of new materials.

Speaker Bio:

Steven McIntosh is currently and Assistant Professor of Chemical Engineering at the Lehigh University. He received his Bachelor of Engineering with 1st class honors from the University of Edinburgh, Scotland, in 1999 and his MS and PhD in Chemical Engineering from the University of Pennsylvania in 2001 and 2004, respectively. His graduate work was conducted

under the supervision of Prof. Raymond Gorte and his PhD was entitled 'Development of Direct Hydrocarbon Solid Oxide Fuel Cells'. He spent a postdoctoral period in the Inorganic Materials Science group of Prof. Henny Bouwmeester at the University of Twente, NL. Dr. McIntosh was an assistant professor at the University of Virginia from 2006 to 2010, prior to joining the faculty at Lehigh University in Fall 2010.

Dr. McIntosh's work has been cited more than 850 times. He was awarded a Marie Curie Intra-European Postdoctoral Fellowship from the European Union in 2004 and received a National Science Foundation CAREER award in 2007. His research interests are in electrochemistry, catalysis and solid-state ionics with a particular focus on solid oxide fuel cell development.

