

**SPONSORS**

PLATINUM

GOLD

PQ/ZEOLYST

SILVER

EVONIK/DEGUSSA

LUMMUS TECHNOLOGY INC.

LYONDELLBASELL

**CLUB OFFICERS**

CHAIR

Michael A. Smith  
Villanova University

CHAIR-ELECT

Dion Vlachos  
University of Delaware

PAST CHAIR

Hai-Ying Chen  
Johnson Matthey

TREASURER

Stephen H. Harris  
LyondellBasell Industries

SECRETARY

Bjorn Moden  
Zeolyst International

PROGRAM CHAIR

Raul Lobo  
University of Delaware

ARRANGEMENTS CHAIR

Bill Lonergan  
University of Delaware

DIRECTORS

Wei Huang  
Air Liquide

Joseph Fedeyko

Johnson Matthey

Elizabeth Ross-Medgaarden

LyondellBasell Industries

NATIONAL REPRESENTATIVE

Anne Gaffney  
Lummus Technology, a CB&I Company

# Catalysis Club of Philadelphia

Thursday September 17, 2009

Holiday Inn Select Hotel

Naamans Road and I-95, Claymont, DE

## 2009 Catalysis Club of Philadelphia Award Lecture: New Concepts in Catalytic Membrane Reactor Science

Prof. S. Ted Oyama

Virginia Polytechnic Institute and State University

&

## Gas-phase Coupling Behavior in Surface Reactions Studied by In Situ Surface Imaging and Scanning Mass Spectrometry

Daniel Bilbao

University of Delaware  
(Student Talk, 15 minutes)

**Social Hour: 5:30 PM**

**Dinner: 6:30 PM**

**Meeting: 7:30 PM**

Members: \$30.00

Walk Ins & Non-members: \$35.00

Student & Retired Members:  
\$15.00

### **Menu**

**Chicken Champagne**

**Maryland Crab Cake – Served with  
our own Remoulade Sauce**

**Vegan - Portabella Napolitano**

**Meal reservations** - Please notify your company representative or Bill Lonergan (lonergan@udel.edu, phone: 518-369-6857, fax: 302.831.1048) by **Thursday September 10.**

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

**Membership** - Dues for the 2009-10 season will be \$10.00 (\$5.00 for the local chapter and \$5.00 for the national club). Dues for students and post-docs will be \$6.00 (\$5.00 for local club and \$1.00 for national club). Please send your payment to Steve Harris, LyondellBasell Industries 3801 West Chester Pike, Newtown Square, PA 19073-2387.

# Catalysis Club of Philadelphia

Thursday September 17, 2009

Holiday Inn Select Hotel

Naamans Road and I-95, Claymont, DE

## 2009 Catalysis Club of Philadelphia Award Lecture: New Concepts in Catalytic Membrane Reactor Science

**Prof. S. Ted Oyama**

Department of Chemical Engineering  
Virginia Polytechnic Institute and State University  
Blacksburg, Virginia 24061-0211

### Abstract

Several important novel concepts in membrane reactor (MR) science are presented. First, a quantity called the operability coefficient (OC) is introduced, which describes the optimal relationship between permeance and reaction rate. Second, a new criterion is developed that describes the boundary between the applicability of one- and two-dimensional mathematical descriptions of MRs. Lastly, the utilization of a MR for the mixing of dangerous components is demonstrated. The concepts are supported by experimental results using as model reactions the methane steam-reforming at high pressure and propylene epoxidation with  $H_2/O_2$  mixtures. The work is made possible by the recent development of an inorganic membrane with permeability for  $H_2$  higher than palladium and with greater than 99.9% selectivity over larger species like CO,  $CO_2$  and  $CH_4$ . The membrane is a composite formed by the deposition of a thin, 30 nm  $SiO_2-Al_2O_3$  layer on a specially designed alumina support. The support is obtained by the deposition of boehmite sols of controlled size on top of a porous substrate, so as to create a graded structure with increasingly small pore sizes. The membrane has excellent stability to steam at high T (873 K) for prolonged times (> 500 h).

### Award Announcement

The winner of the 2009 Catalysis Club of Philadelphia Award is Professor Ted Oyama from Virginia Polytechnic Institute. Professor Oyama is recognized for his outstanding contributions and leadership in catalysis research. In his early work, he made significant contributions to our understanding of catalytic reactions on metal carbides, nitrides and oxides. Professor Oyama uses state-of-the-art spectroscopy methods to obtain information about catalysis in the working state. He currently works in three areas: the oxidative transformation of hydrocarbons to high-value products, the development of novel catalysts for the upgrading of petroleum resources and the development of membranes and membrane reactors for the selective separation of gases. The award announcement was made at the 2009 Spring Symposium. Professor Oyama will be honored during his award lecture, scheduled for September, with a plaque and a \$1000 cash award.

