TEXAS A&M UNIVERSITY at QATAR

CHEMICAL ENGINEERING PROGRAM

THE CHEMICAL ENGINEERING PROGRAM CORDIALLY INVITES YOU TO

Distinguished Seminar on Reaction Engineering and Catalysis

Tuesday May 26, 2009
11:00 a.m. – 1:00 p.m.
Lecture Hall 144 – first floor
Texas A&M at Qatar Building, Education City
(light lunch will be served)

Speaker I:
Dr. Daniel Shantz
Associate Professor &
Associate Head for Graduate Programs
Artie McFerrin Department of Chemical Engineering
Texas A&M University, College Station

Bio

Professor Shantz joined the faculty of Texas A&M in 2001. Dr. Shantz has developed an internationally recognized program in nanostructured materials at Texas A&M and was promoted to Associate Professor in 2006.

Session I

"Towards the Rational Design of Porous Solid Catalysts"

Abstract

Porous solids have enabled many aspects of modern society due to their ability to facilitate chemical reactions. Future technological advances will in part be predicated on the ability to rationally design solids that perform chemical reactions with unsurpassed activity and selectivity. This will impact numerous fields of relevance to the global community.

This talk will summarize recent efforts in my laboratory aimed at advancing this field. The first part of the talk will focus on zeolites that contain multiple heteroatoms in the framework, specifically germanium and aluminum. It has long been known that many of the desirable catalytic properties of zeolites are due to the incorporation of elements other than silicon in the framework. However much of this work has focused on 'single component' substitution, most notably aluminum and titanium. I will summarize our efforts in trying to understand how to rationally tune zeolite structure compositions and the challenges faced in this area, with the specific example of including both germanium and aluminum in the zeolite lattice. I will point out both our successes and potential pitfalls, and the central role robust analytic tools such as porosimetry, X-ray photoelectron spectroscopy, and X-ray absorption spectroscopy occupy in characterizing these materials.

The second part of the talk will highlight some recent work in my lab investigating the catalytic properties of organic groups covalently attached to silica. We have found that simple heterogenized amines will catalyze a diverse range of chemistries. I will focus my discussion on how the surface structure, polarity, and the nature of the amine group affect both the catalytic activity as well as the stability of the active site.

Speaker II:
Dr. Hae-Kwon Jeong
Assistant Professor
Artie McFerrin Department of Chemical Engineering
Texas A&M University, College Station

Bio

Professor Jeong joined the faculty of Texas A&M on December 2006. Dr. Jeong has earned his PhD from University of Minnesota in 2004 and his Postdoc from University of Illinois in 2006.

Session II

"Zeolite Molecular Sieve Membranes with Optimized Microstructure for High Resolution Light Hydrocarbon Isomer Separations: Toward Commercial Applications"

Abstract

Zeolite membranes have attracted a great deal of research interest due to their remarkable ability for high resolution gas separation, in particular hydrocarbon isomers such as p-/o-xylene and i-/n-butane. Control of microstructure such as preferential orientation of pores, size and shape of grain boundary and membrane thickness are of critical importance to improve the performance of zeolite membranes. For instance, a submicrometer-thick *b*-oriented MFI zeolite membrane has shown dramatically increased membrane performance as compared to randomly-oriented or other oriented ones. Despite this promising result, the current synthesis methods still pose technological challenges to the commercial applications of zeolite membranes. These challenges include control of membrane microstructure, low reproducibility, and time-consuming and complicated synthesis steps.

In this talk, I will discuss two breakthroughs that came out from our group. First, I'll talk about a simple method to make continuous *b*-oriented MFI membranes with controlled grain boundary structure. The key feature of the method is to preserve the orientation of b-oriented seed crystals by passivating the flat crystal faces, suppressing the nucleation and growth of crystals along the out-of-plane direction while allowing the growth of crystals along the in-plane direction. In addition, this method allows us to systematically manipulate the membrane thickness by using plate-like seed crystals with different thickness along the *b*-axis ranging from 0.5 μm to 2.0 μm. Secondly, I'll talk about a novel method to control the grain boundary structure of *c*-oriented MFI membranes. The c-oriented MFI membranes with optimized grain boundary structure show a remarkable separation of xylene and butane isomers. Both of these methods have great potentials to address many of the current engineering challenges for practical applications of zeolite membranes by enabling the fabrication of highly oriented zeolite membranes with control microstructure in a simple, commercially-viable manner.

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