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*Promoting Catalytic
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Catalysis Club of Philadelphia

Thursday, October 17th, 2019

Crowne Plaza Wilmington North
630 Naamans Road, Claymont, DE 19703

Speaker: Prof. Jeffrey D. Rimer

Catalysis Club of Philadelphia October Meeting
University of Houston

**Discovering New Paradigms in the Design and Preparation
of Heterogeneous Catalysts**

Graduate Student Speaker: Tariq Bhatti

Rutgers University – Goldman Group

**Teaching Iridium Pincer Complexes to Breathe Air: Transferring H₂
to New Acceptors via Proton-Coupled Electron Transfer**

Meeting Schedule:

Social Hour 5:30 PM

Dinner 6:30 PM

Meeting 7:30 PM

Meeting Fees:

Members: \$40.00

Non-Members: \$45.00

Stud. & Retired Members: \$25.00

Menu

*A broiled Maryland crab cake
appetizer, served with Crowne salad,
Tiramisu and your choice of 3 entrees:*

- 1) Herb Roasted Half Chicken –
Served with Au Jus
- 2) Baked Flounder – *Stuffed with
mushrooms and spinach*
- 3) Eggplant parmesan – *Layered
with mozzarella cheese*

Meal reservations – Please
register online by **Friday,**
October 11th at

<http://catalysisclubphilly.org/>

or notify your company
representative or our
Treasurer Josh Pacheco
(Josh.Pacheco@pgcorp.com)
or Chair Jacob Dickinson
(Jacob.G.Dickinson@dupont.com)

Membership - Dues for the
2019-20 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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Prof. Jeffrey D. Rimer

Discovering New Paradigms in the Design and Preparation of Heterogeneous Catalysts

University of Houston, Department of Chemical and Biomolecular Engineering

Abstract: Catalyst design falls within the broader area of crystal engineering, which focuses on methods of designing and/or optimizing materials for diverse applications. The ability to selectively control catalyst synthesis to achieve desired physicochemical properties relies upon detailed understandings of the thermodynamic and kinetic factors regulating crystal nucleation and growth, which are generally lacking. Research efforts that collectively aim to design innovative approaches to tailor crystallization and exploit unique structure-performance relationships have the potential to produce materials with superior properties beyond what is achievable by conventional routes. In this talk, I will focus on the development of two classes of catalysts: metal oxides and zeolites. Our group is using unique methods to tailor the size, morphology, and surface architecture of catalysts, such as the implementation of growth modifiers that selectively bind to crystal facets and alter anisotropic rates of crystal growth.¹ Efforts in our group have collectively focused on optimizing catalysts for C₁ chemistry (e.g. methanol to hydrocarbons reaction). Improvements in catalyst performance (selectivity, lifetime) will be discussed along with efforts in our group to establish commercially-viable platforms for catalyst synthesis with concomitant control of crystal polymorphs, purity, and composition.² One of the major challenges associated with catalyst design is the need for an improved molecular-level understanding of nucleation and crystal growth. To this end, our group actively studies pathways of crystal formation with the overarching goal of using this information to guide the design of improved catalysts. For example, our group uses a broad range of experimental techniques to examine the mechanism of zeolite nucleation and crystal growth for different framework types. We have pioneered the use of *in situ* atomic force

microscopy (AFM) to capture time-resolved images of growing zeolite surfaces in real time.³ This novel technique has led to the first *in situ* characterization of zeolite growth with the capability of resolving surface dynamics at the spatiotemporal scales necessary to elucidate mechanistic pathways of crystallization. These studies will be discussed along with novel routes in metal oxide synthesis to selectively tailor crystal habit.⁴

References

- (1) Kumar, M.; Luo, H.; Roman-Leshkov, Y.; Rimer, J. D. *J. Am. Chem. Soc.* **2015**, *137*, 13007.
- (2) Maldonado, M.; Oleksiak, M. D.; Chinta, S.; Rimer, J. D. *J. Am. Chem. Soc.* **2013**, *135*, 2641.
- (3) Lupulescu, A. I.; Rimer, J. D. *Science* **2014**, *344*, 729.
- (4) Susman et al., *Chem. Mater.* **2018**, *30*, 2641.

Speaker Details: Jeffrey Rimer is the Abraham E. Dukler Professor of Chemical Engineering at the University of Houston. Jeff received B.S. degrees in Chemical Engineering and Chemistry from Washington University in St. Louis and Allegheny College, respectively. In 2006, he received his Ph.D. in Chemical Engineering from the University of Delaware. Prior to joining the Department of Chemical and Biomolecular Engineering at Houston in 2009, he spent two years as a postdoctoral fellow at New York University's Molecular Design Institute within the Department of Chemistry. Jeff's research in the area of crystal engineering focuses on the rational design of materials with specific applications in the synthesis of microporous catalysts and adsorbents, and the development of therapeutics to inhibit crystal formation in pathological diseases. Jeff has received numerous awards, including the ACS Doctoral New Investigator Award, the NSF CAREER Award, the 2016 Owens Corning Early Career Award and 2017 FRI/John G. Kunes Award from AIChE, the Joe W. Hightower Award from ACS, the inaugural 2017 Netherlands Center for Multiscale Catalytic Energy Conversion Lectureship Award, and the inaugural 2016 Mellichamp Emerging Leader Lecturer at the University of California at Santa Barbara. In 2018 Jeff received the prestigious Norman Hackerman Award in Chemical Research from The Welch Foundation. He has also been the recipient of several research and teaching awards, including the Junior Faculty Research Excellence Award from the Cullen College of Engineering, the Excellence in Research and Scholarship and the Early Faculty Award for Mentoring Undergraduate Research from the University of Houston, and Teaching Excellence Awards at both the University and College level. Jeff served as chair of the Southwest Catalysis Society and is an executive committee member for the American Associate for Crystal Growth, vice chair of the International Zeolite Association (IZA) Synthesis Commission, treasurer of the IZA, chair for the Gordon Research Conference on Crystal Growth and Assembly, chair for the Gordon Research Conference on Nanoporous Materials and Their Applications, and he is a member of the advisory boards for *AIChE Journal* (Wiley), *Molecular Systems Design & Engineering* (RSC), and *Reaction Chemistry & Engineering* (RSC).



Tariq Bhatti

Teaching Iridium Pincer Complexes to Breathe Air: Transferring H₂ to new acceptors via Proton-Coupled Electron Transfer

Rutgers University, Department of Chemistry and Chemical Biology

Abstract: Alkanes are our most abundant natural organic resource; yet controlled, selective, chemical transformations of them remain rare. Homogeneous pincer iridium compounds have established themselves as the most active, robust, and selective catalysts for dehydrogenating alkanes to give alkenes, which are building blocks of industrial organic chemistry. But an enduring challenge for these systems is the need for stoichiometric olefinic hydrogen acceptors to facilitate thermoneutral conversion under relatively mild conditions. Atmospheric oxygen is the most economically ideal and green terminal hydrogen acceptor — either when used directly or through an electron transport chain. In this presentation I will describe an unanticipated, oxidatively-driven, intramolecular C-H addition reaction at a 4'-pyridyl pincer iridium compound. This potentially opens a new avenue toward alkane dehydrogenation via proton-coupled electron transfer: a mechanism with promise for aerobic and electrochemical alkane dehydrogenation. Relatedly, this compound also performs a novel "oxygen activation" reaction. Progress on catalytic aerobic alkane dehydrogenation will also be shared.

Speaker Details: Tariq Bhatti was introduced to chemistry as a teenager, conducting experiments in his garage lab. After earning his B.S. in chemistry from the University of Maryland at College Park in 2009, he spent a few years working as an industrial analytical chemist. This included two years with W.R. Grace's Specialty Catalysts business where he worked on Ziegler-Natta polypropylene catalysts, Methanol-to-Olefin catalysis, and UNIPOL polypropylene technologies. In 2015, he began graduate research in mechanistic organometallic chemistry with Alan S. Goldman at Rutgers University - New Brunswick. He is motivated by the potential of catalysis to reduce environmental harm, address humanitarian needs, and mitigate conflict.