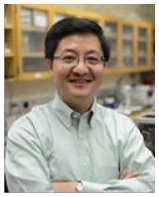
Catalysis Center for Energy Innovation

**GUEST SEMINAR SPEAKER**

**Friday, September 2, 2016**

11:00 AM ▪ 322 ISE




## Yong Wang

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**Biography:** Dr. Wang joined PNNL in 1994 and was promoted to Laboratory Fellow (highest scientific rank in national labs) in 2005. He led the Catalysis and Reaction Engineering Team from 2000 to 2007, and has served as the Associate Director of the Institute for Integrated Catalysis (IIC) since 2008. In 2009, he assumed a joint position at Washington State University and PNNL. In this unique position, he continues to be a Laboratory Fellow and associate director of IIC at PNNL and is the Voiland Distinguished Professor in Chemical Engineering at WSU. He is best known for his leadership in the development of novel catalytic materials and reaction engineering to address the issues related to energy and atom efficiency for converting fossil and biomass feedstocks to fuels and chemicals. He has authored >220 peer reviewed publications with H index=57 and more than 13,000 citations (Google Scholar Citations). He has co-edited 2 books and 6 special journal issues, and given more than 120 invited presentations since 2001. He is the inventor on 252 issued patents including 97 issued U.S. patents (>90% of his patents are licensed to industries). His discoveries in microchannel reaction technologies led to the formation of Velocys, trading under the London Stock Exchange (VLS). He was recently elected to National Academy of Inventors (NAI) and the Washington State Academy of Science (WSAS) and is a fellow of 4 professional societies: AIChE (American Institute of Chemical Engineers), ACS (American Society of Chemistry), RSC (Royal Society of Chemistry), and AAAS (American Association of the Advancement of Science). He has won numerous awards including 2006 Asian American Engineer of the Year Award, Presidential Green Chemistry Award, 3 R&D 100 Awards, Distinguished Alumni Achievement Award from Chemical Engineering at WSU, 2 PNNL Inventor of the Year Awards, Battelle Distinguished Inventor Award, and the first recipient of PNNL Laboratory Director's Award for Exceptional Scientific Achievement Award. He is the past chair of the Energy & Fuel Division of the American Chemical Society, and currently serves as the director to the Catalysis and Reaction Engineering division of AIChE and on the editorial board of 7 catalysis and energy related journals including ACS Catalysis and Catalysis Today.

**"Fundamental Understanding of Bimetallic and Acid-base Catalysis for the Upgrading of Biomass-derived Feedstocks"**


**Abstract:** Biomass-derived feedstocks can be upgraded to fuels and chemicals by C-C bond formation and deoxygenation. In this talk, two examples will be given on our recent advances in: 1) elucidation of key roles of Lewis acid-base pairs for the C-C bond coupling of oxygenates via adolization; and 2) fundamental understanding of Fe-based bimetallic catalysts for efficient hydrodeoxygenation (HDO) of phenolics. We report that a balanced Lewis acid-base pair on ZnxZryOz can achieve cascade (cross) coupling and self-deoxygenation reactions. Specifically, groups of small oxygenates including alcohols, aldehydes, ketones, and carboxylic acids can be converted to olefins with up to 80 mol% carbon selectivity to C3=-C6=. This study provides significant advantages over many of the current catalysts by its unique way to permit selective C-C bond formation and oxygen removal suitable for upgrading a wide range of biomass derived feedstock and intermediates. We found that the addition of precious metals remarkably promotes the activity of Fe for HDO of m-cresol in the order of Pd < Pt < Ru < Rh, resembling the order of sticking probability of H2. In addition, the M-Fe catalysts showed similar selectivity as Fe with high toluene selectivity (C-O cleavage), while precious metals showed higher C-C cleavage. A mechanism including precious metal facilitated H2 dissociation, desorption of aromatic products, and water formation is proposed for the observed synergy. We further demonstrated the concept of "substrate channeling" by steam reforming of C2/C3 oxygenates in pyrolysis oil and delivering hydrogen thus produced to the Fe based catalyst for HDO of furan and phenolic species in pyrolysis oil, which provides a potential strategy for ex situ catalytic pyrolysis of biomass without the requirement of external H2.