UNIVERSITY OF LOUISVILLE

COLLEGE OF ARTS & SCIENCES

Department of Chemistry

Brown and Williamson Series

Friday, November 8, 2019
@12:30 pm
Chemistry Building, LL-16

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Designing Transition Metal Phosphide Nanoparticles and Composites for Effective Electrocatalytic and Photocatalytic Water Splitting

ABSTRACT: Transition metal phosphides are of considerable research interest due to the wide range of catalytic functions they exhibit. These include hydrodesulfurization of fossil fuels, hydrodeoxygenation of biofuels, and electrocatalytic water splitting reactions, among others. However, the functionality of the phosphide is sensitively dependent on composition, structure and particle size. In order to better understand the roles of structure, electronics, and surface chemistry on catalytic activity and stability, synthetic methods that enable composition, structure, and size to be targeted, and that yield low-polydispersity samples, are needed. In this presentation, the synthesis of bimetallic phosphide nanoparticles of formula $M_{2-x}M'_xP$ (M, M' = Mn, Fe, Co, Ru, Rh) will be described and their composition-dependent activity for electrocatalytic water splitting presented. The role of structure, site occupancy, and electronic considerations on functionality will be discussed in the context of designing more active and stable electrocatalysts. Finally, as a means to translate electrocatalytic activity into photocatalytic activity, the design of porous nanoparticle assemblies that blend phosphides with light-harvesting sulfide nanoparticles will be described and their efficacy for photocatalytic water reduction discussed in light of interfacial characteristics. The talk will conclude with a discussion of the importance of rational nanomaterials synthesis and design in addressing 21st century energy and environmental needs.

BIO: Stephanie Brock is a native of the Pacific Northwest. She attended the University of Washington as an undergraduate (B.S. Chemistry, 1990), performing research on oxygen-atom transfer reactions under the direction of Professor James M. Mayer. Brock attended graduate school at U. C. Davis, where she worked with Professor Susan M. Kauzlarich in the area of solid state chemistry. Her dissertation focused on the synthesis and structure-magnetic property investigations of layered pnictide and pnictide-oxide compounds of Mn and Zn. She graduated in March of 1995 and then stayed on for several months as a postdoctoral associate where she studied mixed metal pnictide oxides. Brock began a postdoctoral position at the University of Connecticut in August of 1995 with Professor Steven Suib. There, she developed expertise in soft chemistry routes to nanomaterials through the synthesis and characterization of novel manganese oxide colloids. She also worked with ac-glow discharge plasmas for hydrogen generation and carbon dioxide decomposition. In the Fall of 1999, Brock began a tenure-track position in the Department of Chemistry at Wayne State University and was promoted to Associate Professor with tenure in 2005 and Full Professor in 2009. She is a Fellow of the AAAS and the ACS and the recipient of an NSF-CAREER award. She also serves as an Associate Editor for the ACS journal *Chemistry of Materials*. Her research interests lie in the synthesis, properties and applications of metal pnictide and chalcogenide extended solids and nanomaterials and sol-gel methods for nanoparticle assembly.