Analytical Chemistry Seminar

Tuesday, April 23, 2024
3:30 p.m. ~ WTHR 320

"Surface Sensitive Measurement Techniques for Enhanced Understanding of Electrocatalytic Processes"

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Bio:

Brian Tackett received a B.S. in chemical engineering from the University of Pittsburgh (2013) and a Ph.D. in chemical engineering from Columbia University (2019), completing a thesis on electrocatalysis under the advisement of Jingguang Chen. Tackett then held a National Research Council Postdoctoral Fellowship at the National Institute of Standards and Technology (NIST, 2019 – 2021), where he studied characterization of electrocatalytic phenomena at the electrode-electrolyte interface. Tackett joined the School of Chemical Engineering at Purdue in August 2021, where he established a lab that investigates electrocatalytic reactions that can help decarbonize industrial chemical processes. His group specializes in applying unique electrocatalytic characterization tools, like mass spectrometry and vibrational spectroscopy, to reveal surface reaction phenomena at the solid-liquid electrocatalyst interface. His group then wields this knowledge to perform reactor analysis for continuous flowing electrochemical reactors. Tackett is also passionate about chemical engineering and electrochemistry education. He currently teaches a course on Electrochemistry and Electrochemical Engineering that provides students with a technical working knowledge of electrochemical concepts, taught from a chemical engineering perspective.

Abstract:

Electrocatalytic processes will play a vital role in energy storage and decarbonized chemical manufacturing, which are necessary components of a sustainable economy. Optimization of these reactions requires fundamental understanding of surface electrode reactions under applied potentials. To date, it has been challenging to extract this information, due to many intertwined chemical and physical phenomena occurring near the electrode-electrolyte interface in aqueous electrocatalytic environments. Here, I present examples of surface-sensitive measurement techniques that target of these near-surface processes to enhance understanding of intrinsic catalytic chemistry. This presentation will focus mainly on the use of a new configuration for electrochemical mass spectrometry and its application for (i) understanding surface restructuring of Cu(111) electrodes, (ii) measuring real-time hydrogen production during aqueous zinc metal battery operation, and (iii) quantifying adsorption properties for decarbonized electrochemical light alkane activation. I will also discuss a complementary technique for sensing local reaction-induced pH changes by controlling the mass transport with a rotating ring-disk electrode. These examples will demonstrate the versatility of surface sensitive electrochemical measurement techniques as enablers for a variety of decarbonization technologies.

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