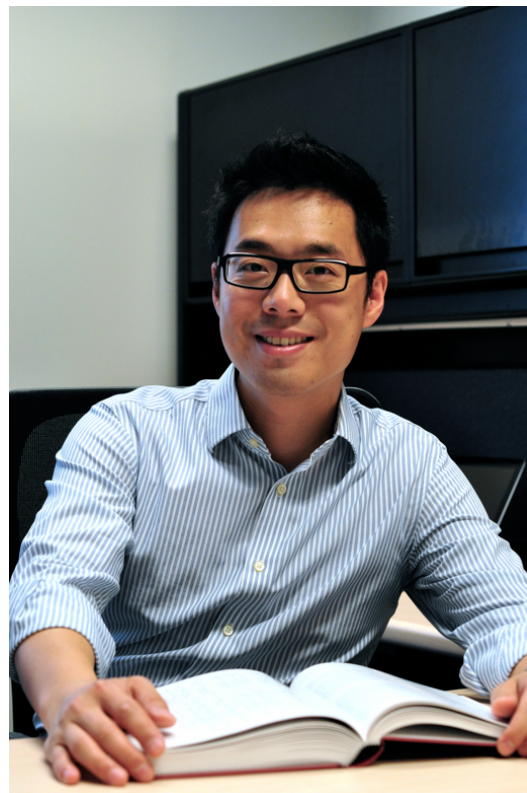


Deciphering surface mediated thermo- and electro- catalytic reactions with in-situ spectroscopies

Abstract: Developing active, selective and energy efficient heterogeneous catalytic processes is key to a sustainable future because heterogeneous thermo-/electro- catalysis is at the center of the chemicals and energy industries. Molecular level understanding of the interaction between the substrate and the surface provides the basis for rational catalyst design. Application and development of spectroscopic techniques capable of probing properties of catalytic sites and identifying reaction intermediates at or close to reaction conditions are key to establishing reliable structure-activity relations. We employ attenuated total reflection – surface enhanced infrared absorption spectroscopy (ATR-SEIRAS) to investigate the electrode surface mediated reactions, e.g., electrochemical reduction of CO₂, and interplay between electrolytes and electrodes, e.g., the influence of nonspecific adsorption of cations on the adsorbates. Combining with isotopic labeling and electrokinetic techniques, a comprehensive mechanistic understanding of surface-mediated electrochemical processes could be achieved. Further, variations of infrared spectroscopic techniques are also powerful in obtaining mechanistic information biomass upgrading processes in both gas and liquid phases, which will be demonstrated with several representative examples.



Bio:

Bingjun Xu is currently an Assistant Professor in the Department of Chemical and Biomolecular Engineering at University of Delaware. Dr. Xu received his Ph.D. in Physical Chemistry, advised by Prof. Friend, from Harvard University in 2011. His thesis established a mechanistic framework for oxidative coupling reactions on the Au surface through surface science studies. Dr. Xu worked with Prof. Davis at Caltech on the development of a low temperature, manganese oxide based thermochemical cycle for water splitting. Upon finishing his postdoc, he joined the Department of Chemical & Biomolecular Engineering at University of Delaware in 2013. The current research interest of the Xu lab spans heterogeneous catalysis, electrocatalysis and in-situ spectroscopy. Dr. Xu is an awardee of NSF Early Career Award (2017), the Air Force Office of Scientific Research Young Investigator Award (2017), and the ACS Petroleum Research Fund Doctoral New Investigator Award (2015).