DEPARTMENT OF CHEMISTRY AND ENVIRONMENTAL SCIENCE
SEMINAR SERIES
SPRING 2020

DATE: WEDNESDAY, APRIL 29, 2020

LOCATION: WEBEX MEETING ROOM

TIME: 1:00PM

GUEST SPEAKER
Prof. Elizabeth R. Young
Assistant Professor
Department of Chemistry, Lehigh University
Bethlehem, PA

TOPIC

Photo-induced Charge Transfer Dynamics of Proton-Coupled Electron Transfer in Inorganic and Organic Systems and in thin films of light harvesting Sb_2S_3

ABSTRACT

Energy conversion processes are driven by charge transfer. Most chemists think primarily of electron rearrangements involved in chemical reactions, however, protons are intimately involved in facilitating these critical energy storing and harnessing reactions. To understand these chemical processes, fundamental, mechanistic understanding of electron transfer (ET) coupled with proton motion is critically important in order to connect molecular structure with chemical reactivity. Drawing from nature, chemists have sought insight from this proton-coupled electron transfer (PCET) to improve energetic and kinetic favorability of chemical transformations. Chemists can seek additional energetic advantage by using solar energy to drive such coupled reactions. Therefore, fundamental mechanistic insight to the influences of proton motion on photo-induced ET is imperative to connect molecular structure with photo-chemical reactivity. Mechanistic study of excited-state PCET must modulate both the ET and proton transfer (PT) pathways in model systems. This talk will describe our efforts with excited-state PCET model systems based on highly oxidizing rhenium carbonyl-based photo-oxidants and azo-dyes. Further, I will introduce our recent work on stibnite (Sb_2S_3), which can be employed as the photo-active layer in next generation thin-film solar cells. Sb_2S_3 is of particular interest due to the suitable band gap of 1.7 eV and high absorption coefficient (1.8×10^5 cm^{-1} at 450 nm). I will present our work using transient absorption spectroscopy to *directly* observe carrier diffusion, electron transfer, hole transfer and charge recombination through uniform ultra-thin (< 3 nm) layers of insulating or transport materials deposited by atomic layer deposition (ALD) that are coupled to photo-active materials. Our results will be used to correlate the structure and

function of material thickness and transport type to develop a fundamental, detailed, quantitative understanding of photo-induced ET dynamics through thin films of materials.

BIO

Elizabeth R. Young grew up in eastern Pennsylvania. She attended Haverford College as an undergraduate where she majored in Chemistry and minored in German, while also playing intercollegiate soccer and squash. As an undergraduate researcher, Liz worked in with Prof. Julio de Paula on porphyrin-peptide nano-wires – during which time her love of photochemistry and spectroscopy was ignited. After completing her undergraduate studies, Liz spent a year abroad in Germany as a participant in the Congress-Bundestag Youth Exchange for Young Professionals. While in Germany, Liz learned about the German culture and language while working in the biophysical laboratory of Prof. Dr. Joachim Spatz at the University of Heidelberg. Upon returning to the U.S., she attended graduate school at the Massachusetts Institute of Technology earning a Ph.D. in Physical Chemistry. Her work in the laboratory of Prof. Daniel G. Nocera focused on photo-induced charge transfer coupled to proton motions in small-molecule donor-acceptor systems. Liz then spent two years as an NSF ACC-F post-doctoral fellow in the electrical engineering laboratory of Prof. Vladimir Bulovic at MIT learning about charge transfer in organic semiconductor devices.

In 2011, Liz began her independent career working with undergraduates at Amherst College. Liz moved back to Pennsylvania in 2017 to Lehigh University where she is currently an Assistant Professor. Her research efforts focus on understanding excited-state charge transfer processes for a range of applications, including excited-state proton-coupled electron transfer reactions in model system and photo-induced charge transfer in materials of interest for next generation photovoltaic devices.

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