MECHANICAL ENGINEERING SEMINAR

Materials design and the study of active interfaces for solar fuel synthesis devices

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The discovery of new materials and their organization into efficient nanoscale architectures can have transformative effects on modern energy conversion devices. This is especially true for solar photoelectrocatalytic devices for fuel production, which at present lack the required efficiency and product selectivity for commercialization. When a new promising material is applied, open questions inevitably present themselves regarding the atomic- or nanoscale nature of the associated new interfaces. Understanding the electronic structure and chemical nature of interfaces is critical because they are the source of electrochemical potential gradients for charge separation and of active sites for electrocatalytic reactions.

In this talk, I will discuss the design of materials for this application through examples using two general methodologies. The first involves the discovery and characterization of new materials and nanoscale architectures that enable the water oxidation reaction, a key half reaction for solar fuel production. The second approach presented emphasizes the use of simplified model systems to assess the physical origins of efficiency. Here primarily spectroscopic techniques are used to (1) study the electronic structures of active interfaces, and (2) characterize the interaction of water with relevant crystal surfaces.

Dr. Coleman X. Kronawitter is a Postdoctoral Research Associate at Princeton University in the Department of Chemical and Biological Engineering. His research emphasizes the design of materials for energy applications and he is particularly focused on understanding origins of efficiency in processes for solar energy conversion. Dr. Kronawitter received a B.S. in Mechanical Engineering from Rutgers University in 2006 and a M.S. in Mechanical Engineering from the University of California, Berkeley in 2010. In 2012 he received a Ph.D. in Mechanical Engineering from the University of California, Berkeley, with a concentration in Energy Science and Technology. His research activities are highly cross-disciplinary and span diverse aspects of energy conversion, including nanotechnology, applied physics, chemistry, environment/ecology, and materials science.

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10:30-11:30am
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