

UC SAN DIEGO NANOENGINEERING SEMINAR

Wednesday, September 26, 2018

Seminar Presentation: 11:00am – 12:00pm

SME 248

“From Molecules to Devices: Mechanistic Analyses of Electrochemical Energy Systems”

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Abstract: In an energy landscape with increased environmental concerns and reduced availability of fossil fuels, electrochemical systems will likely play a major role for automotive and grid-storage applications. Our research strives to diagnose and overcome challenges related to electrochemical energy storage. We focus on mechanistic analysis that integrates both theory and experiment. In this talk, I will discuss three applications of the aforementioned research approach ranging from the molecular to the device scale. In the first, we consider the origin of pH-dependent kinetics for hydrogen evolution and oxidation. Using single-crystal voltammetry and microkinetic modeling, we find that adsorbed hydroxide is a spectator at best and a poison at worst. The implications of this finding on electrocatalyst design are discussed. In the second application, we investigate the effect of inter-electrode communication on failure mechanisms in Li-ion batteries. Electrochemical characterization of surface films using redox mediators separates transport and kinetics to determine how nominally passivating films can selectively transfer charge. These results highlight the importance of a defect-free inorganic layer for a successful interface. Finally, we apply our approach to battery electrode design. We combine rheology with electrochemical analysis to determine the role of carbon microstructure in battery performance and reach the counter-intuitive conclusion that short-range electron transport is more limiting than either long-range conductivity or tortuous ion paths.

Biosketch: Maureen Tang joined the faculty of Chemical and Biological Engineering at Drexel University in Fall 2014. She received her B.S. in Chemical Engineering from Carnegie Mellon University and her Ph. D. from the University of California, Berkeley. She is the recipient of a NSF CAREER award, NSF Graduate Research Fellowship, and JSPS/NSF East Asia Pacific Summer Fellowship. Her thesis submission was a finalist for the 2012 Dance Your PhD competition, sponsored by the American Association for Advancement of Science. Dr. Tang has completed postdoctoral work at Stanford University and research internships at Kyoto University, the University of Dortmund, and Dupont. Her research at Drexel develops materials, architectures, and fundamental insight for electrochemical energy storage and conversion.