Mechanical Engineering **SEMINAR**

Pathways to Improved Lifetime of Electrochemical Energy Systems: Understanding the Influence of Materials Interfaces

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In novel materials for electrochemical energy storage and conversion, dynamic processes at internal solid-solid interfaces, as well as at the solid-electrolyte interface, must be understood and controlled for improved performance.

In this talk, the influence of interfaces will be discussed in the context of two different systems, batteries and solar fuels devices. First, the reaction of lithium with silicon nanostructures (a novel negative electrode material for Li-ion batteries) is explored with *in situ* transmission electron microscopy (TEM). The experiments reveal that the movement of a two-phase interface between the reacted and unreacted material affects both the reaction kinetics and particle fracture through the evolution of large internal stresses. In the next part of the talk, I will discuss tailoring the solid/electrolyte interface of semiconducting electrodes with metal oxide layers to significantly improve stability against photocorrosion during photoelectrochemical solar fuels production. Together, these results demonstrate the importance of controlling interfaces in energy systems, and they are a step towards improved electrochemical devices.

Matthew McDowell graduated from Georgia Tech in 2008 with a B.S. in Materials Science and Engineering, and he earned his Ph.D. in Materials Science and Engineering from Stanford University in 2013. He is currently a postdoctoral scholar in the Division of Chemistry and Chemical Engineering at Caltech. His research has focused on developing materials for electrochemical energy systems and understanding their properties and functionality at the nanoscale. He was awarded the Materials Research Society Graduate Student Gold Award in 2013 for his thesis research.

Monday: March 2nd, 2015

10:30-11:30am

Room 214 Mudd