**Department of Chemical Engineering**

**Seminar Series**

**Designing Dye-Sensitized and Electrocatalytic Systems for Water Oxidation**

John Swierk

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**Abstract**

One possible strategy for solar energy storage is in the form of reduced chemical bonds, often referred to as artificial photosynthesis. Hydrogen can be generated from the electrolysis of water at a minimum potential of 1.23V, which can be satisfied by solar energy with a wavelength less than 1000 nm. Developing real systems to accomplish visible light-driven water-splitting requires minimizing energy losses energy losses that are primarily kinetic in nature. Water-splitting dye-sensitized photoelectrochemical cells  (WS-DSPECs) accomplish visible light-driven water-splitting using molecular sensitizers and water oxidation catalysts co-deposited onto mesoporous metal oxide electrodes.  Despite a low  requirement for the catalytic turnover rate, the quantum yield of water -splitting in WS-DSPECs is typically low (<1%). In this talk I will describe the kinetic bottlenecks that limit the efficiency of WS-DSPECs and explore materials design strategies that target these bottlenecks. I will also discuss how electrochemical impedance spectroscopy can be utilized to identify the causes of large kinetic overpotentials in water oxidation electrocatalysts.

**Bio**

Dr. Swierk received a B.A. in Chemistry and a B.S.E. Materials Science and Engineering from the University of Pennsylvania in 2008.  Following his time at UPenn he joined the research group of Professor Thomas Mallouk, studying the electron transfer reactions in Water-Splitting Dye-Senstized Photochemical Cells.  He received his Ph.D. in Chemistry in May 2014 and began a postdoc at Lawrence Berkeley National Lab as part of the Joint Center for Artificial Photosynthesis with the Molecular Catalysis Group.  There he worked under the supervision of Professor T. Don Tilley and explored the electrochemistry heterogenous first-row transition metal oxygen evolution catalysts.  In 2015, he joined the Yale Energy Sciences Institute as a postdoctoral chemist working with Professor Charles Schmuttenmaer to develop and characterize molecular energy conversion systems.

**Seminar**

**Wednesday, Feb 21**

**3:00 pm**

**Livermore 10**