MECHANICAL ENGINEERING—ENGINEERING MECHANICS

Graduate Seminar Speaker Series

Proudly Presents:

Dr. Karl Walczak

Joint Center for Artificial Photosynthesis

Lawrence Berkeley National Laboratory

Dr. Karl Walczak is a Project Scientist, in the Joint Center for Artificial Photosynthesis (JCAP) at Lawrence Berkeley National Laboratory. JCAP aims to develop a cost-effective and carbon-neutral artificial solar fuel generation technology. The organization includes engineers and scientists with a range of expertise including: chemists, physicists, theoreticians, and chemical, electrical, mechanical and manufacturing engineers. Dr. Walczak integrates research findings related to catalysts, membranes, light absorber, and component interfaces into functional prototypes to guide further research. His work is involves designing, fabricating, and developing analytical tools to assess these artificial photosynthetic prototypes. His current research effort is focused on the development of high efficiency artificial photosynthesis prototypes: >10% solar to hydrogen energy conversion efficiency and device lifetimes >10 hours. He is interested in the challenges of scale-up and manufacturing, especially with respect to life cycle costs and environmental impacts.

Dr. Walczak received his Ph.D. in Mechanical Engineering and Engineering Mechanics from Michigan Technological University, with Prof. Craig Friedrich serving as his advisor. His doctoral research involved designing, fabricating, and validating a sensor platform. The two main components of the sensor platform were bacteriorhodopsin, a light sensitive cellular membrane protein, and a single electron transistor. After graduating, he conducted research to support ultra high speed data transmission in aerospace applications, which involved fabricating polymer optical waveguides, integrating them with printed wiring boards, and developing board-level high-speed optical interconnects.

Thursday, March 5, 2015

4:00 pm — 103 EERC

Artificial Photosynthesis Prototypes

Sunlight is one of the most abundant potential energy sources available and yet it only contributes about 1% of the global energy supply. Today, there are a variety of technologies being developed to harness solar energy. One such technology is photoelectrical chemical solar fuel generation, generally referred to as artificial photosynthesis (AP). Unlike solar cells, which convert sunlight directly to electrical potential, AP converts sunlight to chemical potential, i.e., by splitting water into hydrogen and oxygen. This research is focused on establishing methodologies, technologies, and analytical tools for developing and analyzing AP prototypes. We are currently, developing AP prototypes with >10% solar-to-hydrogen conversion efficient using III-V compound semiconductor materials and exploring methods to improve their performance at relevant scales. Ongoing research aims to enable large-scale implementation by improving efficiency, increasing lifetime, establishing manufacturing processes and systems, and decreasing life cycle environmental impacts, which will all support reduced prospective costs.