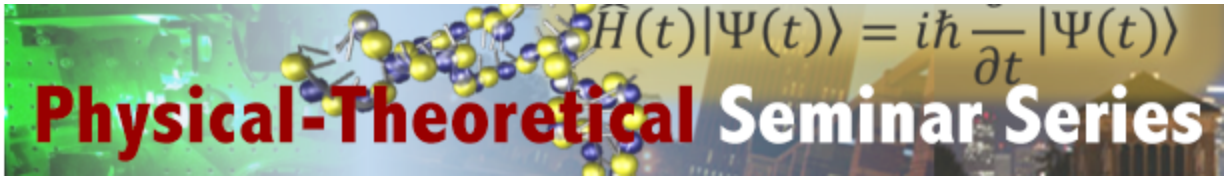

Monday, November 20, 2017, 12:00 pm
Seaver Science Library, Room 150
SSC Auditorium next to the library

Professor Shane Ardo

Department of Chemistry
University of California Irvine

Protonic Solar Cells By Sensitization of Passive Ion-selective Polymers With Photoacid Dyes

Most electrochemical technologies that operate under ambient conditions require ion-conducting polymer electrolytes. These polymers are *passive* in that electric bias drives ion migration in the thermodynamically favored direction. Recently, my group engineered two important features into passive ion-selective polymers to introduce the *active* function of photovoltaic action and demonstration of an ionic solar cell. These features were covalent bonding of photoacid dyes to the polymers such that absorption of visible light resulted in liberation of protons, and synthesis of polymer membranes with charge-selective contacts to facilitate separation and collection of H+ and OH–. The observation of photovoltaic action required that photoacids were located in an ion-selective polymer. Light excitation from either side of the polymer membrane resulted in H+ dissociation, followed by charge separation in a direction dictated by the built-in electrostatic asymmetry in the polymers. Joining a monopolar cation-selective polymer to a monopolar anion-selective polymer forms a bipolar membrane, which mimics a rectifying semiconductor pn-junction diode in form and function. Using a photoacid-dye-modified bipolar membrane, we measured a photovoltage of ~120 mV under conditions of solar-simulated excitation. In addition to more traditional electrochemical techniques, insights into materials function were obtained using finite-element numerical modeling of photoacid kinetics and membrane physics, solid-state NMR, SEM–EDS, fluorescence microscopy, pulsed-laser spectroscopy, and electrochemical impedance spectroscopy. Collectively, these photo-responsive polymers represent a new class of materials that use light to trigger changes in local pH and/or electrostatic potential. These local changes can be used to affect macroscopic processes such as direct solar desalination of saltwater, triggering cellular processes, redox chemistry, or chemical catalysis.

Suggested Reading:

Reiter, R. S.; White, W.; Ardo, S. *Journal of The Electrochemical Society* **2015**, *163*(4).

White, W.; Sanborn, C. D.; Reiter, R. S.; Fabian, D. M.; Ardo, S. *Journal of the American Chemical Society* **2017**, *139*(34), 11726–11733.

Hosted by Professor Anna Krylov
The scientific community is invited

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