



Graduate Seminar (EEL 6936)
Department of Electrical Engineering
http://ee.eng.usf.edu/Grad_Seminar

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Photosynthetic Proteins and Light Harvesting Complexes for Solar Energy Conversion

Abstract

Coal-fired power plants remain to be the major source of electricity generation in 2014, and the goal of restraining climate warming to 2°C is becoming increasingly onerous with every passing year. Harvesting of solar energy can potentially be a promising solution here. However, material and processing costs continue to be the most important limitation for the commercial devices. Now bio-photoelectrochemical cell technologies exploit biomimetic means of energy conversion by utilizing plant-derived photosystems, which can be inexpensive and ultimately the most sustainable alternative. Along these lines, my research seeks to mimic photosynthesis to harvest solar energy. A typical bio-photovoltaic (PV) structure uses immobilized reaction center (RC) proteins on the surface of a metallic/semiconducting electrode deployed in an electrochemical cell. When the electrode is illuminated, electron-hole pairs are generated in the proteins and the photocurrent is driven by the charge transfer between the RC and the electrode. The circuit is completed via the second electrode and ionic charge transport through the electrolyte back to the reaction centers. Although the quantum efficiency in the RC is very high, successfully transferring charges from the protein to the electrodes of a device is challenging. Hence the overarching goal of my work is to increase the power conversion efficiency of protein-based solar cells.



Biography

Houman is currently a doctoral candidate in Electrical Engineering at the University of South Florida (USF) where he is working on photosynthetic reaction center proteins and light-harvesting complexes from purple bacteria, and their hybrid oligomer-protein structures in bio-electronic devices for solar energy harvesting. Additionally, he is actively working on visible-light driven photocatalysts for production of solar fuels (CH₄ and CO). Houman will earn his Ph.D. in the Fall of 2014. He has complete both his B.Sc. and M.Sc. degrees in Material Science and Engineering in 2007 and 2010, respectively.