30.05.2017 Seminar Abstract

Organic Photovoltaic Photoelectrodes for Solar Hydrogen Production

Unlike most traditional wide-bandgap semiconductors used in solar fuels, PV-based solar fuels (e.g. Nocera's silicon based "artificial leaf"[1]) promise high light absorption in the visible spectrum – important for the realization of theoretical maximum quantum efficiency (EQE). Third generation organic photovoltaics (OPV), offer the additional possibility to expand beyond the conventional single bandgap Quessier-Shockley[2] EQE limit via the incorporation of multiple bandgap materials (e.g. tandem structures) thanks to the ready synthetic bandgap tuneability of OPV materials. In addition, organic photovoltaics are host to a wide array of additional exciting manufacturing properties such as solution processability and flexiblility. Yet despite this impressive array of properties, only a few papers report the use of OPV in solar water splitting. Moreover, most existing literature report a promising high photocurrent of milliamps/cm^2 yet a poor in-situ stability of minutes[3]. In this presentation, I will overview some of my previous work at Imperial College on adapting an OPV framework for proof-of-concept photovoltaic photocathodes and photoanodes with enhanced in-situ photoelectrochemical performance and stability.

1. Reece, S. Y. *et al.* Wireless Solar Water Splitting Using Silicon-Based Semiconductors and Earth-Abundant Catalysts. *Science (80-.).* **334,** (2011).
2. Shockley, W. & Queisser, H. J. Detailed Balance Limit of Efficiency of p-n Junction Solar Cells. *J. Appl. Phys.* **32,** 510 (1961).
3. Esiner, S., van Pruissen, G. W. P., Wienk, M. M. & Janssen, R. A. J. Optimized light-driven electrochemical water splitting with tandem polymer solar cells. *J. Mater. Chem. A* **4,** 5107–5114 (2016).