All-in-one Tandem Dye-sensitized Water Splitting Cell

Scientific Achievement

An unbiased water splitting cell with molecular chromophores and catalysts combining mesoporous SnO_2/TiO_2 and a silicon p-n junction

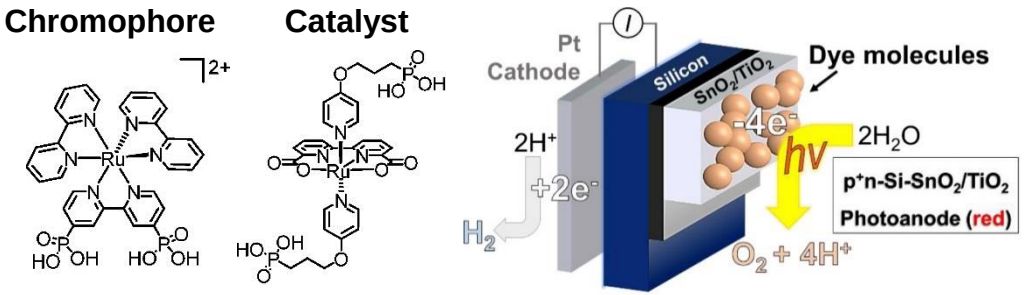
Significance and Impact

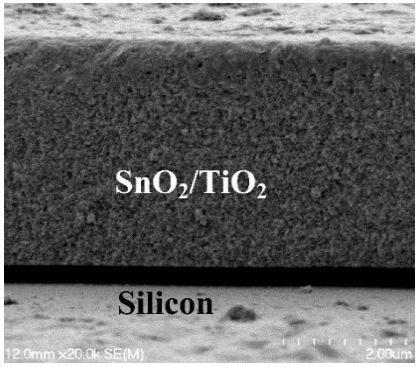
The combination of molecular chromophore/catalysts with conventional silicon represents a new paradigm for design of tandem water splitting cells

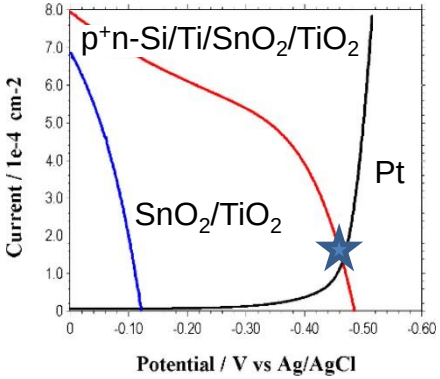
Research Details

- Mesoporous SnO_2/TiO_2 films are derivatized with ruthenium-based chromophores and catalysts, which perform light absorption and water-oxidation catalysis
- Silicon p^+-n wafers provide the additional photo-potential needed for water splitting, with proton reduction at a Pt cathode

M. V. Sheridan, D. J. Hill, B. D. Sherman , D. Wang, S. L. Marquard, K.-R. Wee, J. F. Cahoon, T. J. Meyer. "All-in-One Derivatized Tandem p^+n-Silicon–SnO_2/TiO_2 Water Splitting Photoelectrochemical Cell" *Nano Lett*. ASAP Article, DOI: 10.1021/acs.nanolett.7b00105







Upper: molecular structures (left) of the chromophore and catalyst used to derivatize SnO_2/TiO_2 films, and device schematic (right) of the water splitting cell.

Lower: Cross-sectional SEM image (left) of the silicon/Ti/SnO_2/TiO_2 device, and voltammograms (right) of SnO_2/TiO_2 (blue), Pt (black), and p^+n-Si/Ti/SnO_2/TiO_2 (red) electrodes under 100 mW/cm^2 illumination

Work was performed at the University of North Carolina at Chapel Hill