Development of Dual-Function Light Harvesting Chromophores for DSPEC Applications

Scientific Achievement

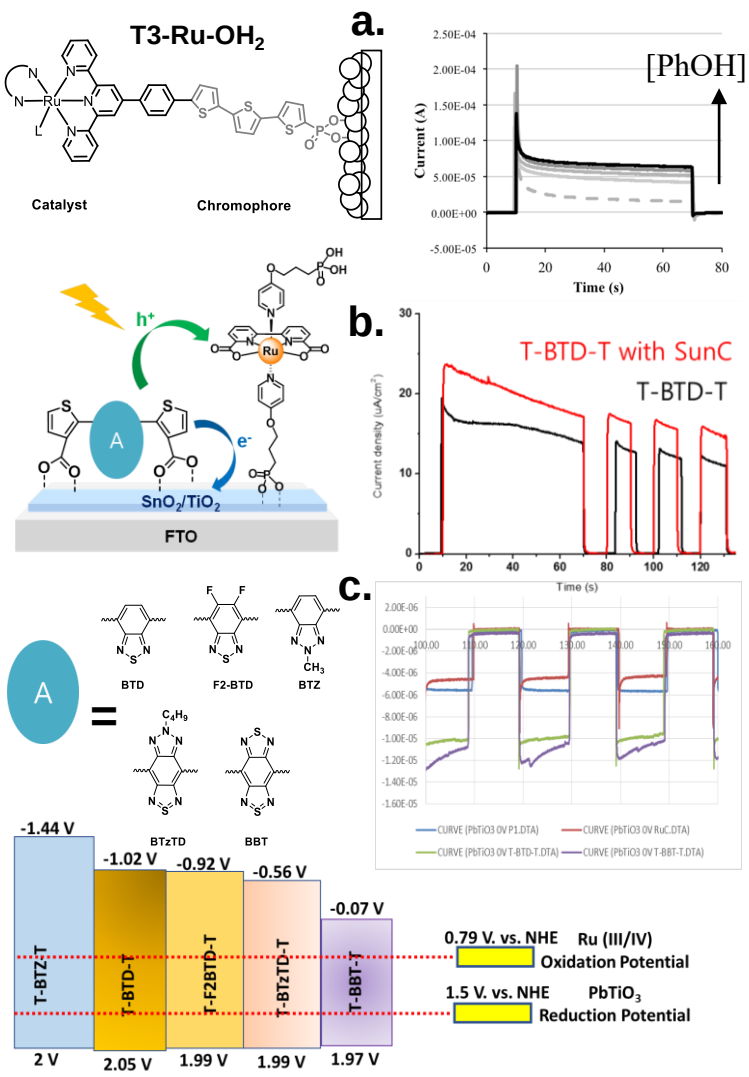
A family of five light harvesting organic chromophores has successfully been designed and synthesized to facilitate light-driven water oxidation and proton reduction at the anode and cathode site of a dye sensitized photoelectrosynthesis cell.

Significance and Impact

By adopting the donor-acceptor-donor (D-A-D) scaffold, we demonstrate structural control over the dye's redox potential. The D-A-D approach brings synthetic accessibility by designing both electron and hole injecting type chromophores via a non-covalent interaction at the catalytic site.

Research Details

- Synthesized the ligand PO_3H_2-terthiophene-trpy (T3) coupled to a ruthenium oxidation catalyst, under aqueous conditions to form the covalently-linked chromophore-metal complex assembly, T3-Ru-OH_2. Increasing phenol (0-16 mM PhOH) concentration in acetate buffer results in increased photocurrent generated at a TiO_2-modified surface.
- Our current family of D-A-D chromophores have varying LUMO levels spanning 1.3 V vs. NHE. These dyes absorb in discrete regions across the UV-Vis (absorbance range from 340 nm - 650 nm).
- In the presence of a SunC water oxidation catalyst on an *n*-type TiO_2 surface, the T-BTD-T trimer generated a photocurrent density of ~24 μA/cm^2 (Schanze).
- T-BTD-T also facilitates hole injection into a p-type $PbTiO_3$ surface, generating a photocurrent of 10 μA/cm^2, one order of magnitude higher than the P1 and RuC photocathode chromophore standards (Cahoon).



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Work was performed at Georgia Institute of Technology, University of Texas at San Antonio, and University of North Carolina at Chapel Hill.

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