

# Efficient Light-Driven Oxidation of Alcohols using an Organic Chromophore-Catalyst Assembly Anchored to TiO<sub>2</sub>

## Scientific Achievement

Designed, synthesized and determined activity of a molecular oxidation catalyst, T3-Ru-OH<sub>2</sub>, to facilitate the light-driven oxidation of phenol and benzyl alcohol in a dye sensitized photoelectrosynthesis cell (DSPEC).

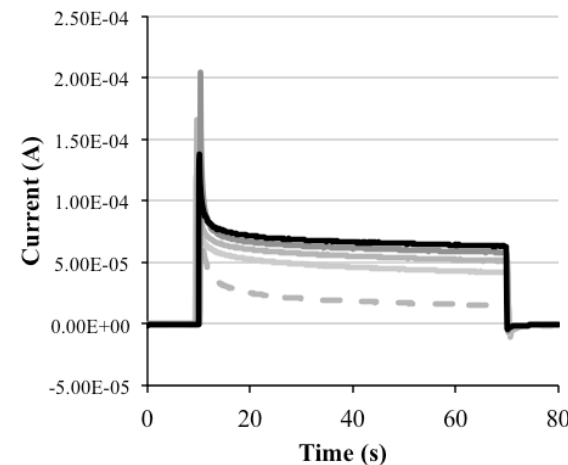
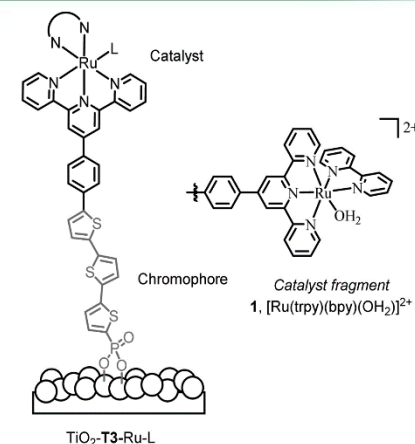
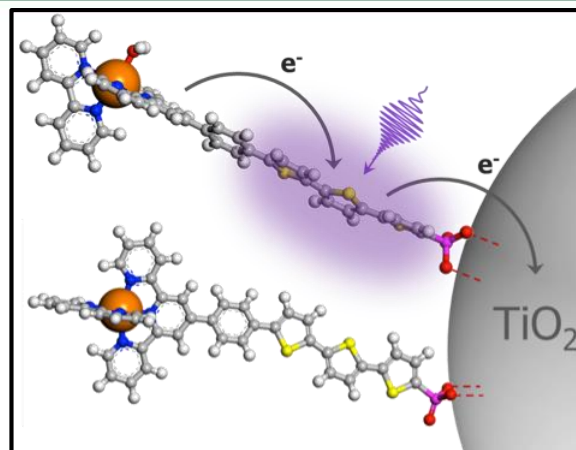
## Significance and Impact

Introduces a new approach to designing catalytically active chromophores that can be applied to metal-oxide interfaces aiding in the development of DSPECs.

## Research Details

- Synthesized and prepared the ligand 5-PO<sub>3</sub>H<sub>2</sub>-2,2':5',2''-terthiophene-5-trpy, **T3**, and a ruthenium oxidation catalyst, [(Ru(bpy)(trpy)[Otf])]<sup>2+</sup> in aqueous conditions to form the chromophore-metal complex assembly, T3-Ru-OH<sub>2</sub>.
- Under aqueous conditions, the phosphonic acid group in the **T3** anchors the molecular catalyst assembly onto the TiO<sub>2</sub> photoanode to facilitate electron injection into the TiO<sub>2</sub>.
- T3** displays efficient electron injection at pH 4.5 demonstrating high photocurrents (~350  $\mu$ A/cm<sup>2</sup>) deriving from hydroquinone oxidation.
- Phenol (PhOH) oxidation results in an increase in photocurrent generated at the TiO<sub>2</sub>-T3-Ru-OH<sub>2</sub> functionalized electrode as a function of PhOH concentration.

T.V. Pho, M.V. Sheridan, Z.A. Morseth, B.D. Sherman, T.J. Meyer, J.M. Papanikolas, K.S. Schanze, J.R. Reynolds ACS Applied Materials and Interfaces, DOI: 10.1021/acsami.6b00932



TiO<sub>2</sub>-**T3**-Ru-OH<sub>2</sub> in pH 4.35, 0.2 M acetate buffer and 0.5 M NaClO<sub>4</sub>, 0 – 16 mM phenol (4 mM increments); E<sub>appl</sub> = 0.2 V. Illumination with 100 mW-cm<sup>-2</sup> visible light,  $\lambda > 400$  nm.

Work was performed at Georgia Tech., U. North Carolina, and U. Florida