Stabilization of Chromophores on TiO_2 by ALD

Meyer

Scientific Achievement

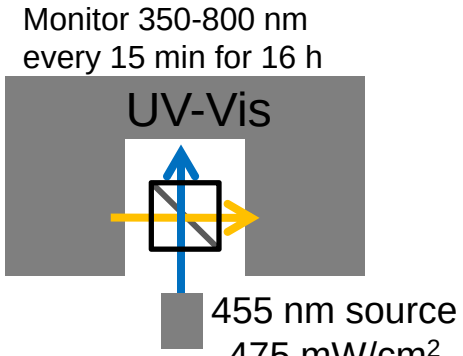
Atomic layer deposition of Al_2O_3 on TiO_2–RuP significantly increasing the stability of the film in aqueous solutions.

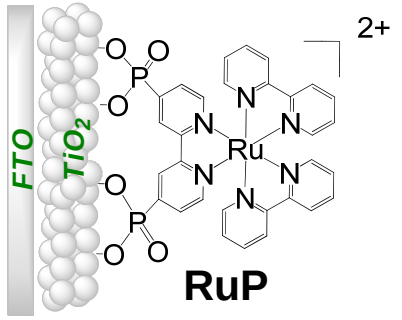
Significance and Impact

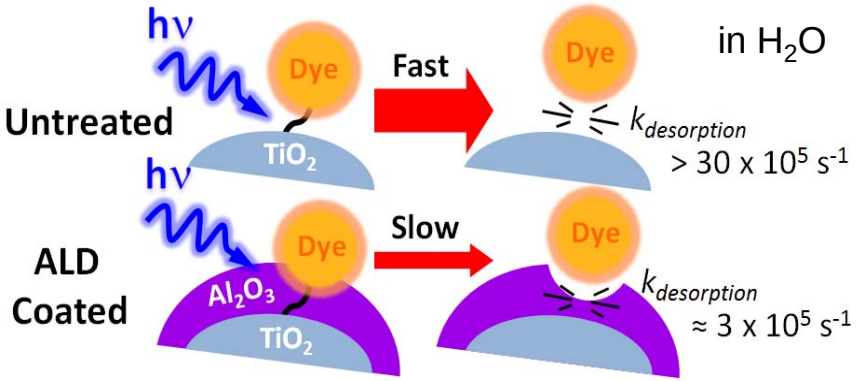
The stabilization of metal oxide bound chromophores/catalysts is crucial for the development of dye-sensitized photoelectrosynthesis cells (DSPECs).

Research Details

- Various thicknesses of Al_2O_3 were deposited on TiO_2-**RuP** via alternating cycles of $AlMe_3$ and H_2O.
- Photostability was measured by a standard protocol and single wavelength kinetics were fit to obtain a desorption rate constant.
- ALD significantly increases the stability of the film (>one order of magnitude, in H_2O)
- ALD of Al_2O_3 also increases emission, decreases injection yield, and slows back electron transfer.







Top Left : Stability measurement apparatus.
Top Right: $[Ru(bpy)_2(4,4'\text{-}(PO_3H_2)bpy)]^{2+}$ on nanocrystalline TiO_2.
Bottom: Schematic for the stabilization of dye molecules on TiO_2 by Al_2O_3.

Hanson, K.; Brennaman, M. K.; Luo, H.; Glasson, C. R. K.; Concepcion, J. J.; Song, W.; Meyer, T. J. *ACS Appl. Mater. Interfaces* **2012**, *4*, 1462.
Hanson, K.; Losego, M. D.; Kalanyan, B.; Ashford, D. L.; Parsons, G. N.; Meyer, T. J. *Chem. Mater.* **2012**, *25*, 3-5.

Work was performed at the University of North Carolina