Solar Energy Conversion with Inorganic Coordination Compounds and Semiconductor Nanocrystallites

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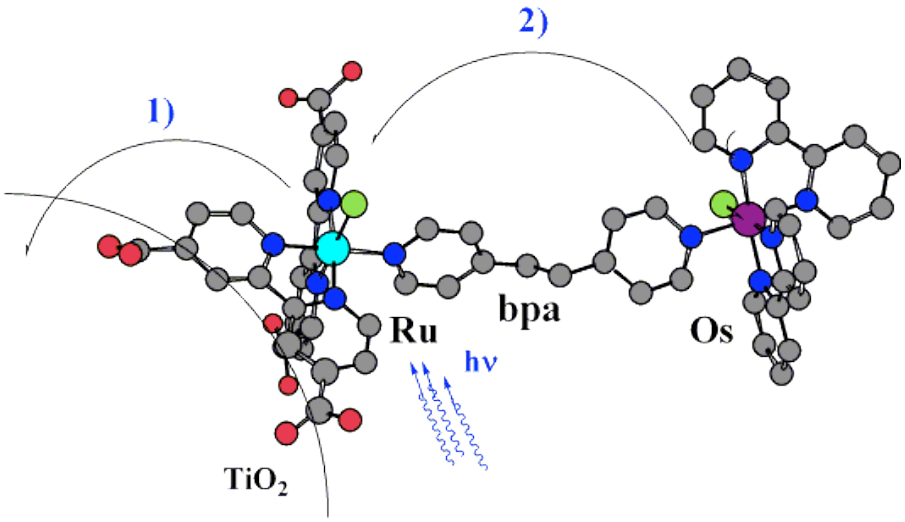

Recently an order of magnitude increase in solar energy conversion efficiencies from dye-sensitized photovoltaic cells has been realized.[1,2] These solar cells are based upon mesoporous thin films of nanocrystalline (anatase) TiO_2 sensitized to visible light with ruthenium coordination compounds that serve as dyes. Under simulated sunlight conditions, solar-to-electrical power conversion efficiencies in excess of 11 % have been confirmed in Asia and Europe. The sensitized materials have an enormous surface area, a long effective pathlength, and a high photoconductivity that affords both spectroscopic and photoelectrochemical characterization of interfacial charge transfer processes.

In this seminar, our recent experimental studies of solar energy conversion and interfacial charge transfer will be presented. Specific topics include mechanisms of interfacial electron transfer and I-I bond formation. "Hetero-supramolecular" compounds that perform more elaborate tasks at semiconductor interfaces, such as intramolecular electron transfer, will also be discussed.[2] These and related studies provide new insights into the factors that control electron transfer at semiconductor interfaces and have implications that extend beyond solar-to-electrical energy conversion to the growing discipline of photocatalysis at sensitized semiconductor surfaces.[2]

[1] O'Regan, B.; Grätzel, M. *Nature* **1991**, *353*, 737-740. [2] Ardo, S.; Meyer, G.J. *Chem.Soc. Rev.* **2009**, *38*, 115-164.