Photo-Induced Charge Separation in TiO2/Porphyrin Bilayers Studied by Time-Resolved Microwave Conductivity

- J. Kroeze, T. Savenije, and J. Warman
(Delft University of Technology)

Interfacial charge separation following flash-photolysis of bilayers consisting of an 80 nm thick, smooth layer of anatase TiO_2 coated with a layer of a (metallo)porphyrin has been studied using the electrodeless, time-resolved microwave conductivity (TRMC) technique. The kinetics, efficiency, and action spectrum of charge separation have been determined. The nature of the central metal substituent is found to have a dramatic influence on the photoconductivity transients observed. Both singlet and triplet photosensitization occur with the former dominant for the metal-free and zinc derivatives and the latter for the palladium-porphyrin complex. The enhancement of the triplet mechanism for the Pd derivative is attributed to a much greater rate of intermolecular triplet energy diffusion resulting from the heavy-atom effect on spin-orbit coupling. Because of this, yields of charge separation per incident photon as high as 12% are found for a TiO_2/PdP bilayer on excitation in the Soret band.