454. Title:Picosecond electron injection dynamics in dye-sensitized oxides in the presence of electrolyte

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Source title:Journal of Physical Chemistry C
Volume:115
Issue:5
Issue date:February 10, 2011
Publication year:2011
Pages:2578-2584
Language:English
Document type:Journal article (JA)

Abstract:We employ time-resolved terahertz (THz) spectroscopy (TRTS) to directly monitor the picosecond dynamics of electron transfer in dye-sensitized oxides in the presence of an electrolyte phase. Understanding the time scale on which electrons are injected from the dye into the oxide phase in the presence of electrolyte is important for optimization of the solar cell efficiency. We quantify injection dynamics from two different dyes into both mesoporous TiO2 and SnO2 films. Measurements are performed in inert media (air, acetonitrile), in the presence of two different electrolytes (the conventional iodine/iodide couple and the recently reported disulfide/thiolate redox couple), and in the presence of two different electrolyte additives (Li+ ions and tert-butyl pyridine). Electron injection dynamics in TiO2 is found to occur on two time scales: sub-150 fs and ∼10 ps, attributed to injection from the singlet and lower-lying triplet state, respectively. For SnO2, injection is slower, despite the lower energy of the band edge. The slow injection observed for SnO2 is attributed to the reduced density of electronic states in the material. We observe that for both oxides electron injection can be strongly retarded by changing the composition of the medium in which the sensitized oxide film is immersed. In particular, our results indicate that injection dynamics can be significantly slowed down in the presence of the disulfide/thiolate redox couple and/or tert-butyl pyridine.