4. Photochemical Charge Transfer in Niobium Oxide Nanocrystal Films Studied with Surface Photovoltage Spectroscopy

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Photochemical charge generation, separation, and transport at nanocrystal interfaces are central to photoelectrochemical water splitting, a pathway to hydrogen from solar energy. Here we use surface photovoltage spectroscopy to probe these processes on niobate nanocrystal films. The observed photovoltages vary between 0 and 1.18 V, depending on the nanocrystals (HCa2Nb3O10, H4Nb6O17, H2K2Nb6O17), substrate material (Au, Al, Ag, F:SnO2, In:SnO2, Cu, Cu2O, NiO, polystyrene), excitation energy (1.0-5.0 eV), illumination intensity (1-35 microW cm-2), illumination time (10-1000 s), and film thickness (100 – 1800 nm). The data from these measurements is used to derive a quantitative model on photochemical charge separation in nanocrystal films.