INTERROGATING INTERFACIAL EFFECTS IN QUANTUM DOT SENSITIZED ZNO WITH DUAL PROBE TRANSIENT ABSORPTION SPECTROSCOPY

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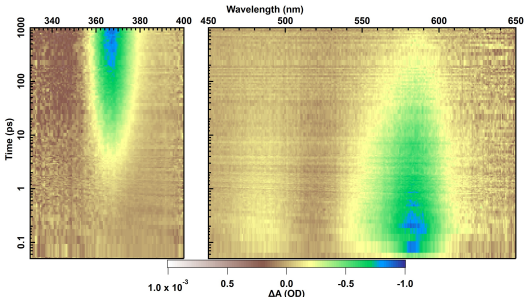

Quantum dot - metal oxide heterostructures (QDHs) have been heavily studied in the past 15 years for their use in harvesting solar energy. Great strides have been made in understanding their limitations, what is still unclear however is how much the two materials interact after charge injection. So far it's been presumed that QDHs share behavior with dye sensitized solar cells after charge injection, but this is not necessarily true. This work applies UV probe transient absorption spectroscopy to measure spectrally distinct signals of ZnO and CdSe, and uses global target analysis to distinguish models of interfacial dynamics. Four samples are measured and analyzed in this way to distinguish effects that can be attributed to quantum dots from effects that can be attributed to ZnO surface chemistry, three with different sizes of CdSe and one with a post-synthesis annealed ZnO sample. All samples showed evidence of split population dynamics that indicates two energetic regimes at play. It's found that an interfacial excitonic state, which is currently a favored explanation, is likely not formed due to the environmental screening of the coulombic interaction. Instead, carriers may localize near the surface due to band bending induced by adsorbed species. This explanation is consistent with a holistic view of the involved materials and previous terahertz conductivity results. Annealing the ZnO increases the overall yield and shifts charge injection towards longer timescales, which can only be explained in the context of band bending.