ULTRAFAST CARRIER DYNAMICS IN QUANTUM DOT SENSITIZED ZnO

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Quantum dot sensitized solar cells have been a rising star in in the field of photovoltaics and materials science. Here, UV probe transient spectroscopy is employed to directly investigate the metal oxide dynamics in CdSe sensitized ZnO. The excitonic transition in ZnO lays at 365 nm, and charge injection results in a bleaching of this transition due to phase space filling. Combining UV and visible probe transient spectroscopy allows direct comparison between the spectrally separated CdSe and ZnO signals.

The two regions show a difference in kinetics, with the ZnO showing a delayed signal from charge injection contrary to the abrupt decay of the quantum dot signal, which has been attributed to the formation of an interfacial exciton at the boundary of the ZnO and CdSe. High fluence measurements with band edge excitation gives evidence that charge injection follows a second mechanism that does not show delayed charge separation, indicating the interfacial exciton state is not forming. Understanding this effect could pave the way for more effective photovoltaics.