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Title:Size-dependent electron transfer from PbSe quantum dots to SnO2 monitored by picosecond terahertz spectroscopy
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Abstract:We report the direct and unambiguous determination of electron transfer rates and efficiencies from PbSe quantum dots (QDs) to mesoporous SnO 2 films. We monitor the time-dependent electron density within the oxide with picosecond time resolution using Terahertz spectroscopy, following optical excitation of the QDs using a femtosecond laser pulse. QD-oxide electron transfer occurs with efficiencies of ~2% in our samples under 800 nm pumping with a marked dependence on QD size, ranging from ~100 ps injection times for the smallest, ~2 nm diameter QDs, to ~1 ns time scale for ~7 nm QDs. The size-dependent electron transfer rates are modeled within the framework of Marcus theory and the implications of the results for device design are discussed.
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