Abstract Submitted
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Ultrafast Electron Trapping in Ligand-Exchanged Quantum Dot Assemblies[1] J. M. KIKKAWA, M. E. TURK, P. M. VORA, A. T. FAFARMAN, B. T. DIROLL, C. B. MURRAY, C. R. KAGAN, University of Pennsylvania — We use time-integrated and time-resolved photoluminescence and absorption to characterize the low-temperature (10 K) optical properties of CdSe quantum dot (QD) solids with different ligand and annealing preparation. Close-packed CdSe quantum dot solids are prepared with native aliphatic ligands and with thiocyanate with and without thermal annealing. Using sub-picosecond, broadband time-resolved photoluminescence and absorption, we find that ligand exchange increases the rate of carrier surface trapping. We further determine that holes within the QD core, rather than electrons, can bleach the band-edge transition in these samples at low temperature, a finding that comes as a surprise given what is known about the surface treatment in these QDs. We find that our ligand treatments lead to faster electron trapping to the quantum dot surface, a greater proportion of surface photoluminescence, and an increased rate of nonradiative decay due to enhanced interparticle coupling upon exchange and annealing.

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