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Do "giant" nanocrystal quantum dots need to be giant to suppress Auger recombination? FLORENCIO GARCIA-SANTAMARIA, RANJANI VISWANATHA, RICHARD SCHALLER, VICTOR KLIMOV, Los Alamos National Laboratory — Nanocrystals quantum dots (NQDs) are attractive materials for various light-emitting applications including optical amplification and lasing. A complication associated with the multiexcitonic nature of light amplification in NQDs is the picosecond optical-gain decay induced by nonradiative Auger recombination. In this process, one exciton recombines by transferring the energy to the other. Recently, we observed that Auger recombination is very efficiently suppressed in a novel type of nanocrystals dubbed "giant" quantum dots (g-NQDs). These g-NQDs comprise an emitting core of CdSe overcoated with a thick shell (up to 20 monolayers) of wider-gap CdS so that the overall particle diameter is larger than 10 nm. Thanks to their long multi-exciton lifetimes these nanocrystals show unusually large optical-gain bandwidth and low amplified-spontaneous-emission thresholds. Here we discuss potential reasons for Auger recombination suppression in these quantum dots and provide evidence that the large size of the nanocrystal is not as important as the properties of the CdSe/CdS interface. Specifically, even dots with just 3 - 4 monolayers of CdS show very long Auger lifetimes after we apply a special treatment, which modifies the core-shell interface.

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