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OPTICAL PROPERTIES OF CdTe AND CdS QUANTUM DOTS IN GLASS

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Abstract

We summarize the linear and nonlinear optical properties of a variety of CdTe and CdS quantum dots in glass. The measured linear absorption of the CdTe sample is compared with calculations involving valence-band mixing due to the quantum confinement. The temperature dependence of the lowest quantum-confined transition and its linewidth for samples with various crystallite sizes are measured and compared with a simple model. It is found that the shift of the energetically lowest quantum-confined transition as a function of temperature is the same as the temperature-dependent band-gap reduction in bulk materials. Excitation of the sample with pulses ranging from femtoseconds to microseconds allows distinguishing between various mechanisms responsible for the observed optical nonlinearities. At very early times, phase-space filling and Coulomb interaction between the excited charged carriers are responsible for the absorption changes. At later times, Coulomb effects due to “trapped” carriers remain and last for nanoseconds or microseconds.