

Exciton Delocalization and Splitting at the Quantum Dot-Organic Interface

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Organic molecules are powerful influences on the properties of semiconductor nanocrystals (quantum dots) through multiple mechanisms. We will discuss the interaction of CdSe, CdS, and PbS quantum dots with two classes of molecules, phenyldithiocarbamates and viologen derivatives. The first class couples directly to the core (specifically the excitonic hole) of the dots and relaxes the quantum confinement of the exciton to result in unprecedented bathochromic shifts in the optical bandgap. The second class ionizes photoexcited QDs to create a radical pair; the charge separation rate depends on the number of viologens “bound” to each QD, so we can use the electron transfer process as a probe of the QD-ligand binding constant.