

Thin Film Structures from Semiconductor Heteronanocrystals Optics and Optoelectronic Applications

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Semiconductor nanocrystals prepared via colloidal chemistry route are popular objects for studying basic properties of quantum-confined semiconductor nanostructures. Colloidal nanocrystals are also important materials for various practical applications, including optically active, electro-optic, luminescence, photovoltaic structures. Here, we discuss the recent results in the preparation and basic optical properties of semiconductor heteronanocrystals, including quantum dots, nanorods and nanoplatelets. We demonstrate the new type of “core-wings” CdSe and Type II CdSe-CdTe heteronanoplatelets have conjugate electron sub-systems important for efficient light harvesting and photogenerated charge separation and extraction in photovoltaic structures. Additionally, CdSe nanoplatelets show extra-large electro-optic response among all types of CdSe nanocrystals (dots, rods, nanoplatelets) which makes them perspective for electro-optic elements for lasers and telecommunication. Doped semiconductor heteronanocrystals are perspective materials for thin film scintillators for X-ray, high energy particles and electron beams. Highly luminescent water-soluble semiconductor quantum dots and nanorods are perspective materials for early-time supersensitive fluorescence immunoanalysis of cancer, bacterial and viral diseases. They can be used alone as fluorescent markers conjugated with different antibodies, or in composition with magnetic and plasmonic nanoparticles for magnetic separation and photothermal and magnetothermal treatment.