Synthesis of ligand-selective ZnS nanocrystals exhibiting ligand-tunable fluorescence

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High-quality ZnS nanocrystals (NCs) of nearly identical size are synthesized using isomeric ligands, o-, m-, p-phenylenediamines (PDAs) that bind to the NC cores. The fluorescence emission from the NC is tunable according to the structure of the isomer. The measured fluorescence quantum yields (QYs) are 2–3 times higher for NCs that are passivated with isomeric PDA ligands than the fluorescence QY of NCs prepared at the absence of PDAs. The NC morphologies were studied by low-angle and wide-angle X-ray diffraction (XRD), and by transmission electron microscopy (TEM). The average correlating sizes were found to be 3.0±0.3, 3.7±0.30, and 3.0±0.5nm for the NCs that were passivated with o-PDA, m-PDA, and p-PDA, respectively. The Fourier-transform infra-red (FTIR) spectroscopy and X-ray photoelectron spectroscopy (XPS) studies were carried out to investigate the shell structure and the interaction between the core and the shell. The adsorbed ligands were quantitatively analyzed by TGA. The structure, morphology, and optical properties of these PDA passivated NCs were compared with the NCs prepared in the absence of PDA.