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Fabrication and optical properties of Cd(Zn)Se and CdSe/ZnS quantum dots and hybrid organic/inorganic light-emitting diode

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Semiconductor quantum dots (QDs) have been the subject of much interest for both fundamental research and technical applications in recent years, due mainly to their strong size dependent properties and excellent chemical processibility. In this dissertation, the synthesis of CdSe, ZnSe and CdSe/ZnS quantum dots were synthesized by pyrolysis of high-temperature organometallic reagents. In order to modify the size and quality of quantum dots, we controlled the growth temperature and the relative amount of precursors to be injected into the coordinating solvent. Moreover, an effective surface passivation of monodisperse nanocrystals was achieved by overcoating them with a higher-band-gap material. Synthesized CdSe, ZnSe and CdSe/ZnS quantum dots were studied to evaluate the optical, electronic and structural properties using transmission electron microscope (TEM), UV-absorption, and photolumine-scence (PL) measurement.

Also, we fabricated quantum-dot light-emitting diodes (QD-LEDs) using CdSe/ZnS quantum dots as their emissive layer can provide tunable emission in the visible spectrum, because of the size-dependent luminescence of the quantum dots. QD-LEDs were constructed with thermal evaporation process and layer-by-layer techniques. We demonstrated the optical properties of ITO/TPD (35 nm)/10ML CdSe/ZnS QDs/Alq3 (40 nm)/Al (70 nm) structure.