Structural and optical properties of PVP-capped nanocrystalline ZnxCd1−xS solid solutions

ABSTRACT

Nanocrystalline ZnxCd1ī xS solid solutions were prepared in a microwave-assisted hydrothermal process with gradient distribution of components (x = 0.1, 0.3, 0.5, 0.7, and 0.9). The growth of the cubic-structured quantum dots was observed for all component stoichiometries with the crystallite size between 4.5 and 5.7 nm. The obvious peak shifts have been found in the XRD patterns and the lattice parameters showed linear variation with x increasing. The evolution of the optical properties of obtained solid solutions including absorption and photoemission was also monitored in detail. The solid solutions show a considerable shift in the nanoparticle optical absorption edge from 482 to 343 nm with the increasing of Zn fraction. The band gaps of the solid solutions were estimated to be between 2.94 and 3.40 eV and the position of conduction band was shifted toward more negative potential with x increasing. The photoluminescence spectra showed a broad blue-green emission spreading up to 600 nm with emergence of three dominant peaks belong to sulfur, zinc, and cadmium vacancies.

Keyword: Ternary quantum dot; Microwave-assisted hydrothermal; Nanoparticles; Semiconductor