Study of microstructure and optical properties of PVA-Capped ZnS: Cu nanocrystalline thin films

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Abstract: A study has been carried out on the Cu doping and PVA capping induced optical property changes in ZnS : Cu nanocrystalline powders and thin film. For this study, ZnS : Cu nanopowders with Cu concentrations of 0.1%, 0.15%, 0.2%, 0.3% and 0.4% are synthesized by the wet chemical method. The polyvinyl alcohol (PVA)-capped ZnS thin film with 0.2% Cu concentration and various PVA concentrations are prepared by the spin-coating method. The microstructures of the samples are investigated by the X-ray diffraction (XRD) patterns and transmission electron microscopy (TEM). The results show that the prepared samples belong to the wurtzite structure with the average particle size of about 3-7 nm. The optical properties of samples are studied by measuring absorption and photoluminescence (PL) spectra in the wavelength range from 300 nm to 900 nm at 300 K. It is shown that the luminescent intensity of ZnS : Cu nanopowders reaches the highest intensity for optimal Cu concentration of 0.2% with the corresponding values of its direct band gap estimated to be about 3.90 eV. While the PVA coating does not affect the microstructure of ZnS nanomaterials, the PL spectra of the samples are found to be affected by the PVA concentration as well as the exciting power density. The influence of the polymer coating on the optical properties can be explained by the quantum confinement effect of ZnS nanoparticles in the PVA matrix. © 2010 World Scientific Publishing Company.

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