Excitation wavelength dependent photoluminescence emission behavior, UV induced photoluminescence enhancement and optical gap tuning of Zn0.45Cd0.55S nanoparticles for optoelectronic applications

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Abstract:

In the present study, we investigate the excitation wavelength (lex) dependent photoluminescence (PL) behavior in Zn0.45Cd0.55S nanoparticles. The deconvoluted PL emission bands for nanopowders and nanocolloids reveal noticeable spectral blue shift with decreasing lex accompanied by intensity enhancement. This unusual behavior is explained in terms of selective particle size distribution in nanostructures, advancing of fast ionization process at short lex; and solvation process in polar solvent. In addition, we attributed the UV-induced PL intensity enhancement and blue shift of the optical gap to the reduction in particle size by photo-corrosion process associated with the improvement in the quantum size effect; surface modification due to cross-linkage improvement of capping molecules at NPs surface; the creation of new radiative centers and the formation of photo-passivation layers from ZnSO4 and CdSO4, and photo-enhanced oxygen adsorption on Zn0.45Cd0.55S nanoparticles surface.

Keywords:

Photoluminescence enhancement Relaxation dynamics process UV irradiation effects Optical gap tuning PL spectral blue shift

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