Optical Properties of $Cd_{1-x}Mn_xS$ Nanoparticles

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$Cd_{1-x}Mn_xS$ quantum dots (QDs) of average size 4.5 nm with various composition, from x = 0.001 to 0.3, have been synthesized by using aqueous solution precipitation. The X-ray analysis showed hexagonal wurtzite structure.

In Raman spectra of $Cd_{1-x}Mn_xS$ nanoparticles asymmetric Raman line was observed. Dominant line was at about 300 cm^{-1} asymmetric broader for $\omega < 300$ cm^{-1}. We considered a single crystalline CdS sphere to calculate the relative contributions of the confined modes to Raman scattering. Second harmonics of these confined modes are registered to. A significant change in intensity for different Mn content and various excitation energies is registered.

The photoluminescence (PL) spectra of studied samples for various excitation energies in magnetic field (up to 5 T) are also presented and analyzed. Beside emission from defect states at about 1.7 eV and from surface states at 2.3 eV, we registered two emission bands at 2.0 and 2.13 eV that correspond to the $^4T_1$-$^6A_1$ transitions of Mn^{2+} ions in two different crystal environments in CdS host lattice. The higher energy level 2.13 eV is related to the Mn^{2+} in a tetrahedral site while the lower level 2.0 eV is caused by lattice disturbance and Mn^{2+} in a octahedral simmetry. This result is in agreement with measurements in magnetic field.