Photoluminescence (PL), scanning electronic microscopy (SEM), Raman scattering, X ray diffraction (XRD) and energy dispersive spectroscopy (EDS) have been applied for the comparative study of ZnO and ZnO:Cu nanocrystals (NCs) prepared by ultrasonic spray pyrolysis. ZnO Cu NCs were annealed at 400 °C for 2 hours in nitrogen flow. Raman and XRD studies have shown that thermal annealing stimulates the ZnO crystallization with the creation of wurtzite crystal lattice. XRD and EDS methods have been used for the confirmation doping of ZnO NCs by Cu atoms and to show that the metallic Cu nanoparticles have been embedded in the ZnO NC films at high Cu content. It is shown that the Raman intensity for all Raman peaks in ZnO Cu NC systems is higher in comparison with undoped ZnO NCs, owing to the surface enhanced Raman scattering (SERS) effect. In ZnO Cu NCs five PL bands appear with the PL peaks at 1.54, 2.08, 2.50, 2.70 and 3.08 eV. The reasons of emission transformation in different samples and the nature of Cu doping related PL band (2.7eV) have been discussed. It is shown that the plasmon generation in metallic Cu nanoparticles stimulates the SERS effect at Raman scattering.

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