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Synthesis and characterization of ZnS prepared by Co-precipitation method

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Zinc Sulphide is an important optoelectronic device material with a wide band gap and it is used for violet to blue light applications. Zinc Sulphide (ZnS) nanoparticles doped with Manganese and Copper have been synthesized with the chemical co-precipitation method using Polyvinylpyrrolidone (PVP) as a capping agent to control the particle growth. The crystal structure and particle size were studied utilising X-ray diffraction and it was found that the un-doped ZnS, the Mn-doped ZnS and the Cu-doped ZnS powders all have the cubic zinc blende crystal structure with a (111) preferred orientation. The crystallite sizes were in the order of 4 nm. UV-visible spectroscopy was used to characterize the powders at room temperature and reflectance measurements were performed on all samples. From these measurements the band gap of the un-doped ZnS, the Mn-doped ZnS and the Cu doped ZnS powders was found to be 3.3 eV, 3.2 eV and 3.1 eV, respectively. Photoluminescence (PL) measurements were performed on all samples with a Cary Eclipse spectrophotometer. From the PL measurements it was found that the un-doped ZnS had a broad emission peak at 480 nm (blue). Both doped samples had the same broad emission peak at 480 nm (blue) with a stronger second emission peak at 605 nm (orange) for Mn-doped ZnS while for the Cu-doped ZnS the second emission peak was at 580 nm (yellow). The broad blue emission is attributed to Zinc or Sulphur vacancies while the orange and yellow emission can be attributed to the Mn and Cu dopants respectively.

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