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Nanocrystalline $Zn_{0.9}Mn_{0.1}S$ Thin Film: Case Studies

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Abstract: Problem statement: The high quality of ZnS:Mn nanocrystals is important in nanotechnology industries. The perfect chemical procedure is significant to produce the best of nanocrystals. Hence, this research is concern on the good chemical method in processing manganese doped zinc sulphide nanocrystals. **Approach:** For the first step, Mn doped ZnS nanocrystals were synthesized by using sol gel spin coating method. After the crystals were obtained, the properties of $ZnS:Mn^{2+}$ on morphology, optical and electrical were determined by using Field Emission Scanning Electron Microscopy (FE-SEM), Ultra Violet Visible Spectroscopy (UV-Vis), Photoluminescence Spectrophotometer (PL) and current-voltage measurement (I-V). **Results:** The particle has diameter size around 22 nm. In this experiment it was found that the current increases with the increasing of applied voltage (-10 V to 10 V). UV-Vis spectra shows appearance of an absorption peak at 250 nm meanwhile in PL analysis spectra, the sample has been recorded at room temperature and two emissions peaks at blue and orange emissions were observed. **Conclusion:** Manganese doped zinc sulphide was successfully synthesized using sol gel spin coating method and it performs in good quality.

Key words: Sol gel, spin coating, zinc sulphide, manganese, optical, electrical

INTRODUCTION

Efficiently luminescing nanocrystalline semiconductors of Mn doped ZnS has attracted much attention due to their unique properties especially in optical and electrical part. Because of these characteristics, this semiconductor which has wider band gap (3.68 eV) is possible to be applied in optoelectronic applications such as optical switches, sensors, electroluminescence devices, biomedical tags, nanophosphors (Monica and Lokendra, 2010; Murugadoss *et al*., 2011; Xiying *et al*., 2011). Actually, Mn^{2+} -doped ZnS nanoparticles have been first reported in 1983 but this ZnS:Mn nanoparticles still have been studied because of their potential applications in future generation due to their extraordinary properties. In producing ZnS:Mn thin film, various technique especially chemical procedures have been mostly used, for example chemical bath deposition, electrochemical fabrication, solvotherma, microemulsion, sol gel method, organometallic methods, passivation procedure, liquid solid solution (Murugadoss *et al*., 2011; Xiying *et al*., 2011). Numerous compound semiconductor nanocrystals have been synthesized using sol gel method has often been reports previously (Yahya *et al*., 2009). Sol gel method is one of the inexpensive and easy method to produce thin film materials. In this paper, we mainly focused on the optical and electrical properties of Mn doped ZnS nanocrystals synthesized via sol gel spin coating method. The optical absorption properties found that the blue shift of the absorption edge is occurred due to quantum confinement effect. In this work, the Mn^{2+} ion is used as a dopant. This ion which has a d configuration can exhibits a broad emission peak (yellow-red emission) corresponding to the $^4T_1$-$^6A_1$ transition (Monica and Lokendra, 2010). While in electrical section, Mn doped ZnS was characterized during external illumination exhibited more current.

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