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VAN DER WAALS DRIVEN SELF-ASSEMBLY APPROACH FOR ZnS NANOPARTICLES

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Abstract: Thin film nanoparticles have been prepared on glass substrate by spin coating and self-assembly method. Combination techniques were used to study on structural thin film using Field Emission Scanning Electron Microscopy (FE-SEM) and the elements were confirmed using Energy Dispersive X-Ray (EDX). The results of this experiment showed that the well-organized nanoparticles were produced with the size of nanoparticle 30-50 nm. EDX analysis confirmed the ZnS nanoparticles with percentage of Zn = 24.9% and S = 0.6 %. Using Van der Walls equation, formation of larger size of nanoparticles influence strong result in van der Waals relation between particles. This outcome can be used to develop nanomaterials in the future.

Keywords: *Structure of thin film, van der Waals, self-assembly, ZnS nanoparticles, sol gel method*

Introduction

Nanophotonic crystals have extraordinary potential especially in optoelectronic devices. They have been incorporated in phosphor, sensor, and waveguide application because they are able to enhance the efficiency of existing technology (Chiappini *et al.,* 2011). Recently, different nanophotonic crystals have been fabricated using various materials such as ZnS, CdS, and ZnO (Ali *et al.,* 2014; Vettumperumal *et al.,* 2013). Self-assembly is a fundamental mechanism and is one of the current popular topics in the field of material research. In simple understanding, self-assembly is a mechanism in which different nanoparticle assembly motifs of even close-packed periodic structures form in materials through spatial arrangement of their fundamental building blocks. Directed self-assembly of nanoparticles refers to the process whereby an intrinsically self-assembling system is aided or modulated using directing agents, external fields, or templates (Marek *et al.,* 2010). Basically, it is much easier to produce nanocrystal-based photonic crystals using modern directed self-assembly fabrication techniques such as etching process (Orloff *et al.,* 1992; Yun *et al.,* 2004), but these techniques are very costly. Therefore, researchers are trying to discover simpler and cost-friendly alternative techniques to produce cost-friendly crystal such as self-assembly approach using spin coating, dip coating, chemical bath deposition, chemical vapor deposition and hydrothermal (Mohd *et al.* 2012).

Previous research shows that good morphology of ZnO:Mn nanoparticles was produced using hierarchical and self-assembly method (Hao *et al.,* 2012). In this process, forces that control self-assembly are determined by competing noncovalent intramolecular or intraparticulate interactions meanwhile the hierarchical structures obtained through the self-assembly of nanocrystalline building blocks provide new opportunities for optimizing, tuning and/or enhancing the properties and performance of the materials. Other research have developed ZnS:Mn nanocrystal using spin coating and self-assembly approach (Noor *et al.,* 2014). Directed self-assembly method was employed to align the nanocrystal in a single layer plane while metal tape was used during spin coating process to prevent ZnS:Mn sol from being splashed out of the boundary line. After undergoing annealing process at certain temperature, a homogeneous nanocrystal was formed but the factors that influence the alignment of nanocrystal were not addressed.

Therefore, the current project considers all possible factors and would suggest the significant factors that affect the arrangement