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Synthesis and thermoluminescence properties of ZnS nanoparticle

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ABSTRACT

In this scientific research ZnS nanoparticle was synthesized via precipitation method. Two samples were synthesized by this method. The nanoparticle was characterized by XRD techniques, and the size and kind of crystallinity were identified by X-ray diffraction pattern as well. The size measurement has been done by using scherrer's equation. The average sizes of nanoparticles in two samples were 11nm and 23nm. In fact, the velocity of stirrer affects the size of particles. Moreover, the study of XRD pattern indicates the cubic structure. This nanoparticle exposed to Gama ray source of ^{60}Co and investigated their thermoluminescence's properties. The result shows that the thermoluminescence intensity increases by the size reduction of nanoparticles.

Keywords: *Thermoluminescence; ZnS nanoparticle; Precipitation method*

INTRODUCTION

Semiconductor nanoparticles have well photophysical and photochemical properties which is size dependant. They have been often used in optical sensors, photoelectronic devices and biological application as DNA detectors. ZnS belong to II-VI group materials. They can be used in optical sensors, electroluminescence devices and solar cells [1]. The thermoluminescence (TL) method is generally used to study the defects in insulator and semiconductor materials. Morever, this method is successfully applied in the field of radiation dosimetry [2].

EXPERIMENTAL

Different methods exist for synthesis of ZnS nanoparticles. In this paper the ZnS nanoparticles was synthesis via precipitation method [3]. Two samples were prepared. Three solutions were separately prepared.

1- 10 ml zinc acetate solution (1M).
2- 10 ml manganes acetate solution (0.1M).

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3- 10 ml sodium sulfide solution (1M).

Zinc acetate solution was diluted by 80 ml distilled water with stirring. Then the solutions (2) and (3) were added dropwise to solution number (1) while the solutions were mixed by magnetic stirrer. Similarly the two samples were synthesized with fast stirring and slow stirring. After centrifugation, we were dried the samples under vacuum pump to prevent any possible oxidation. The two samples prepared with different colors, white and peachy. We used XRD [4] to determine particles' size (Figure 1, 2). The average particle size was calculated by scherrer's formula .The fast rotation sample was 11nm and the slow rotation sample was 23nm.

$$D = \frac{K\lambda}{B \cos\theta}$$

In scherrer's formula λ= 1.54 nm, k=0.9 and B was FWHM in X-ray spectrum.

Figure 3 related to brightness curve of samples that expose to Gama ray of ^{60}Co. The thermoluminescence intensity of ZnS nanoparticles was 1.4nc in fast rotation and 1.24nc in slow rotation. It indicates that, smaller particles have higher thermoluminescence intensity. This experiment confirms that the thermoluminescence intensity increases with decreasing nanoparticle size.

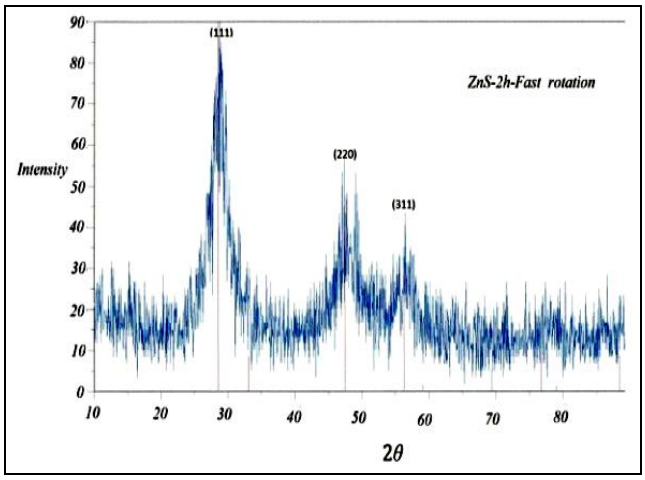

Fig.1. XRD spectrum of fast rotation ZnS

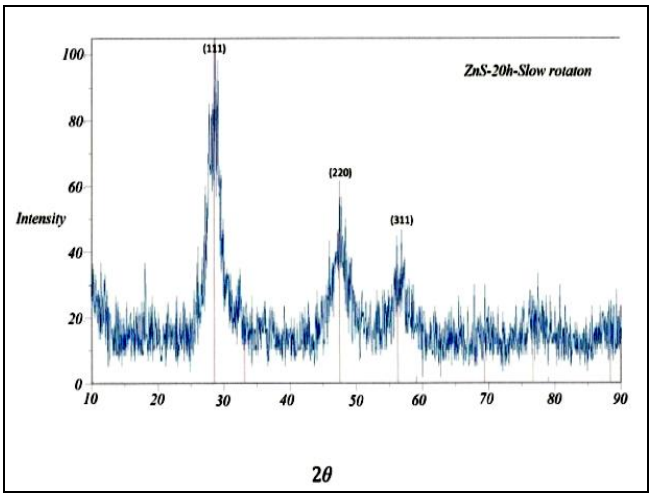

Fig.2. XRD spectrum of slow rotation ZnS

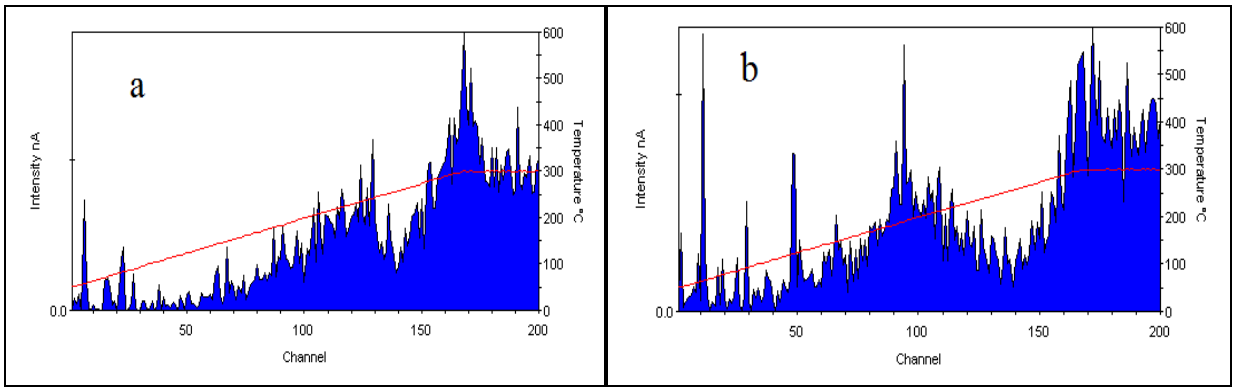

Fig.3. Thermoluminescence spectrum of ZnS a) fast rotaion b) slow rotation

RESULTS AND DISCUSSION

The stirring time and drying time of samples affect the nanoparticles size. When this times increases, particle size is increased.
The XRD spectrum shows that ZnS nanocrystals have cubic structure.

The sizes of nanoparticles were determined with scherrer's formula by X-ray spectrum's data. The size of fast rotation sample was11nm and the slow rotation sample was 23nm.The smaller nanoparticles have higher thermoluminescence intensity.

CONCLUSION

This paper indicates the importance of size effect on luminescence property. The reduction of nanoparticle size enhances the thermoluminescence intensity.

REFERENCES

[1] El-kemary M.,El-Shamy H.,(2009), Fluorescence modulation and photodegradation characteristicsof safranin O dye in the presence of ZnS nanoparticles. *Journal of Photochemistry and Photobiology*. A.205 : 151–155.

[2] NecmeddinYazici A., O¨ ztas M., Bedir M,(2007), The thermoluminescence properties of copper doped ZnSnanophosphor. *Optical Materials* .29 : 1091–1096

[3] SrivastavaA.,Vishwakarma H.,(2009), Synthesis and Optical Properties of Bulk and Doped Zinc Sulfide Nanocrystal. *International Journal of Nanotechnology and Applications*. 3 : 77-81

[4] Borah J.P., Sarma K.P.,(2008), Optical and Optoelectronic Properties of ZnS Nanostructured Thin Film. *Acta physica polonica*. A. 114:237-240.