International Journal of Materials Physics.
ISSN 0974-309X Volume 7, Number 1 (2016), pp. 9-13

http://www.irphouse.com

Characterization of SrAlO:Dy nano phosphors

V.T. Jisha

S.T. Hindu College, Nagercoil - 629 002, Tamil Nadu, India.

Abstract

Dy doped SrAlO nano phosphors were synthesized by adopting a simple Sol-Gel Method. X-Ray Diffraction (XRD) profile confirms the monoclinic nature of Dy doped SrAlO nano phosphors. The results show that SrAlO:Dy with an average particle size of 80 nm is formed. In addition, Scanning electron microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS) and Fourier-Transform IR spectroscopy (FTIR) were also used to characterize the synthesized phosphor. The efficiency of the prepared phosphors was analyzed by means of its emission spectral profiles. We also observed a rich IR emission from the prepared phosphors under a Ultra-Violet (UV) source. Such luminescent powders are expected to be applied as IR sensor and MRI device applications.

Keywords: XRD, FTIR, SEM, sol–gel method .

INTRODUCTION

Now a days, various routes have been used for the synthesis of SrAlO nanomaterials, such as; sol–gel synthesis, hydrothermal/solvothermal meth-ods, microemulsion method, precipitation, and physical vapor deposition. Sol-gel method gives homogenous, high-purity, and high-quality nanopowders. The morphology of the nanoparticles can be changed by changing the solvents.Semiconductor nanomaterials have received great attention. Among these various semiconductor oxide nanomaterials, strontium aluminium oxide is a versatile material because of its physic-chemical properties such as; mechanical, electrical, optical, magnetic and chemical sensing properties. By Sol-gel method CaOSrOAl2O3 thin films using metal alkoxides were prepared and its characteristics were analysed [1]. Structural and optical properties of CaOSrOAl2O3 thin films were derived by sol-gel dip coating process [2]. Doped alkaline earth aluminates processed doped alkaline earth aluminates were synthesized by using sol-gel method [3]. Luminescent properties of europium-activated phosphors were synthesized by using sol-gel method [4]. Characterization study of Zno nanoparticles were synthesized by using solar lamp and plasma display phosphors are based on compounds in the alkaline-earth–rare-earth–aluminate systems. This work is concerned with the systematic relations between luminescence emission and crystal structure for Dy activated alkaline earth aluminates.

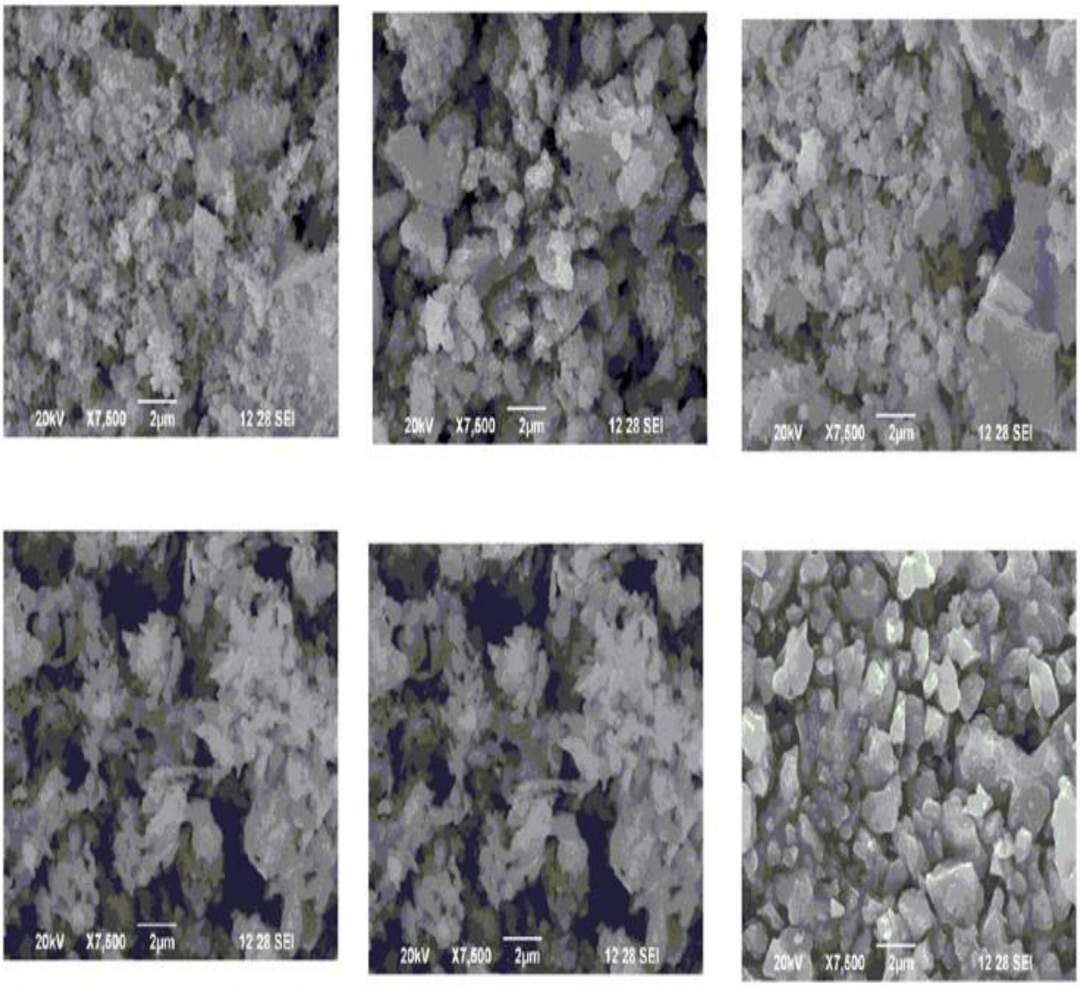
EXPERIMENT

All the reagents used in the experiments were in analytical grade and used without any further purification. The procedure of synthesizing nanoparticles is thoroughly described as follows: 98 wt.% of 2M Strontium acetate [$(CH_3.COO)_2$ $Sr.2H_2O$ was dissolved in 25ml of 2-methoxyethanol with vigorous stirring. 1 wt.% of 2M Dysprosium nitrate [$(CH_3.COO)_2$ $Mn.2H_2O$] was dissolved in 25ml of 2-methoxyethanol with vigorous stirring. Simultaneously, 1 wt.% of 2M Aluminum acetate [$C_4H_6AlO_4.4H_2O$] was dissolved in 25ml of 2-methoxyethanol with vigorous stirring and subsequently, it was added to the to the first solution to reach 50 ml in total. Then it was stirred for 30 min at room temperature for the second time. Ammonia was slowly added to this solution with a constant stirring until a pH of 10.5 was achieved. After the stirring of the solution for 30min, acetic acid and ethylene glycol in the ratio1:1 was added to the solution. The sol was heated at 80°C while being mechanically stirred with a magnetic stirrer. As the evaporation proceeded, the sol turned into a viscous gel. The gel was aged for 2h and then dried at 100°C for about 5h. The resulting materials were well grinded and annealed at 950°C for 2h to obtain Dy doped $SrAl_4O_7$ nanopowders. For the preparation of the gel precursors with different wt%, the same procedure was repeated with the wt% of Dysprosium nitrate being varied to 0.5,2, 3,4 and 5.

RESULTS AND DISSECTION.

1. SEM

Figure1 shows the SEM image of $SrAl_4O_7$: Dy .The micrograph indicates that nearly all the powder particles were composed of same shape nanoparticles. The presence of bigger particles is attributed to the growth of small particles, which is a result of the sol–gel synthesis. Under the reaction time and temperature, some of the tiny particles underwent a self- induced process, aggregate and growth forming bigger particles.



Figures1: The SEM image of $SrAl_4O_7$: Dy

2. XRD

The structure and phase purity of the SrAlO: Dy phosphor were investigated by XRD. The XRD patterns were obtained and are shown in Fig.2 for SrAlO: Dy. Diffraction patterns were obtained using CuKα radiation (λ=1.54051 A^0),at 30kV and 15mA. Measurements were made from $2\theta=10^0$ to 80^0 with steps of 0.02^0. The XRD patterns of the powders revealed that the structure of $SrAl_4O_7$ is Monoclinic, which is match with JCPDS data card No. 25-1289. The crystallites are less than approximately 50-90nm in size appreciable broadening in the X-ray diffraction lines. SEM images $SrAl_4O_7$: Dy, which is un-uniform and may be due to the formation of fractal attribution to sort of self organization. SEM image of $SrAl_4O_7$ sintered at 900ºC for 3hrs appears to irregular shape

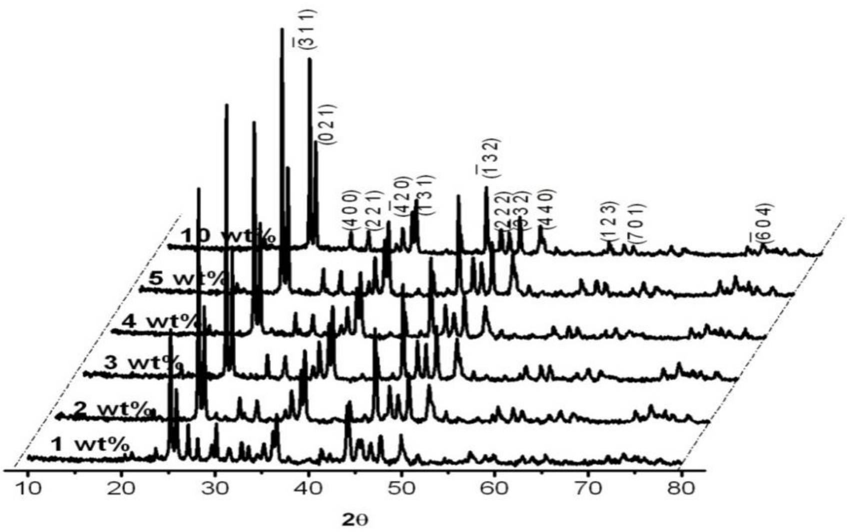


Figure 2: XRD images of Dy doped $SrAl_4O_7$ at different wt%

3. PHOTOLUMINESCENCE

The photoluminescence emission spectra of the $SrAl_4O_7$: Dy shown in the Figure 3. The PL properties of $SrAl_4O_7$: Dy nanopowders were measured at room temperature. In this figure, the PL spectra of both Dy and Mn doped $SrAl_4O_7$ consisted of three parts: one weak peak in the blue region, one strong band in bluish green region and other emission bands in red light region. $SrAl_4O_7$: Dy nanocrystals are found to have increased photoluminescence efficiency .

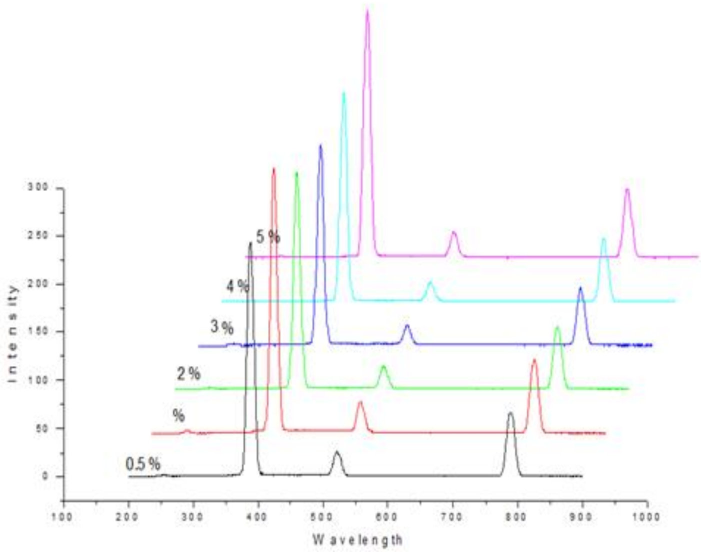


Figure 3: Photoluminescence spectra of $SrAl_4O_7$: Dy

CONCLUSION

In this paper, by using sol-gel method $SrAl_4O_7$: Dy nanoparticles were synthesized. Materials characterization such as; X-ray diffraction (XRD), photoluminescence (PL) emission spectra, scanning electron microscopy (SEM) were analysed. In the results, we report the Dy doped phosphor generates a strong emission at 395 nm,520nm in green region. The prepared $SrAl_4O_7$: Dy nanoparticles are applicable for fluorescent lamp and plasma display applications. The prepared Strontium Aluminate nano powder exhibits monoclinic structure.

REFERENCES

[1] Chavhan P.M., Anubha Sharma, Kim Koushik, Sol-gel Derived 6CaO.6SrO.7Al2O3 Thin Films using Metal Alkoxides, *Ceram. Int.* 2011; 37: 3413–3417p. Available at: http://www.sciencedirect.com/science/article/pii/S027288421100530X

[2] Chavhan P.M., Govind, Anubha Sharma, *et al.* Structural and Optical Properties of 6CaO.6SrO.7Al2O3 Thin Films Derived by Sol-gel Dip Coating Process, *J. Non-*

[3] *Crystal. Solids* 2011; 357: 1351–1356p. Available at: http://www.sciencedirect.co m/science/article/pii/S0022309310006691

[4] Tuomas, Jorma, Jungner, *et al.* Sol-gel Doped Alkaline Earth Aluminates Processed Eu2+ - Doped Alkaline Earth Aluminates, *J. Alloy. Compd.* 2002; 341: 76–78p. Available at: http://www.science direct.com/science/article/pii/S0925838802000683

[5] Zuoling, Yaung, Moon, *et al.* Synthesis and Luminescent Properties of Europium-Activated Ca2SO4 Phosphors by Sol-gel Method, *J. Lumin.* 2009; 129: 1669–1672p. Available at http://www.sciencedirect.com/science/article/pii/S0022231309001161

[6] T.V.Kolekar, Yadav, Bandgar, *et al.* Synthesis by Sol-gel Method and

[7] Characterization of Zno nanoparticles, *Indian streams Res. J.* 2011; 1: 1–4p. ISSN 2230–7850. Available at: http://www.isrj.net/UploadedData/36.pdf

[8] Hoefsloot A.M., Thijssen P.H.F., Metselaar R., *Silic. Ind.* 1985; 35p. Available at: http://alexandria.tue. nl/repository/freearticles/620156.pdf

[9] Suryanarayana C, Nortan MG: *X-ray Diffraction: A Practical Approach*. Plenum Publishing Corporation, New York, 1998. Available at: http://www.hindawi.com/journals/isrn/2013/369670/ref/

[10] Williamson G. K Hall. W. H.: *Acta Met all.*, 1953; 1: 22p. Available at: http: //www.icdd.com/ resources /axa/vol40/ v40_612.pdf

[11] F. Massazza, Fig. 294 in Phase Diagrams for Ceramists, vol. I, American Ceramic Society, Columbus, OH, 1985.

[12] P. Appendino, Rev. Int. Hautes Temp. Refract. 9 (1972) 297