ISSN 0976 – 1411

Available online at www.internationaleJournals.com

International eJournals

International eJournal of Mathematics and Engineering 132 (2011) 1204 - 1208

INTERNATIONAL eJOURNAL OF MATHEMATICS AND ENGINEERING

www.InternationaleJournals.com

PHOTOLUMINESCENCE STUDIES OF NANO PHOSPHOR Sr_2CeO_4:USING COMBUSTION TECHNIQUE

C.Mary Anitha[1], R.Nagapadmini[1], Niyaz Parvin Shaik[2], B.Subba Rao[2,*], N.V.Poornachandra Rao[2], K.V.R. Murthy[3]

[1] Department of Physics, JMJ College, Tenali-522 201,India

[2] Department of Physics, VSR & NVR College, Tenali-522 20, India

[3]Display Materials Laboratory, Applied Physics Department, Faulty of Technology and Engineering, M.S. University of Baroda, Baroda-390 001, India

***Email: bezawadasubbarao1@gmail.com**

ABSTRACT:

The present paper reports the photoluminescence studies of Sr_2CeO_4 phosphor using combustion technique. The photoluminescence and crystalline properties were examined as function of the firing temperature. XRD pattern of synthesized sample at different temperatures have been recorded.The crystal structure of Sr_2CeO_4 was found to be orthogonal by using Scherrer equation.The average crystallite size comes out to be 45nm for the 1200^0c reported.The combustion synthesized sample shows the formation of nano sized particles. Photoluminescence results show that this nano phosphor can be suitable for field emission displays as well as fluorescent lamps.

Key Words : Photoluminescence; XRD; Scherrer equation; Combustion technique; Phosphor
AMS Subject Classification:74E15,82D80,80A25

1. Introduction

The phosphor research has taken a great shape and the current trends in the research and development are to make use of newer and older methods to make the research viable today. The need of the hour is to revolutionize the synthesis technique and modify it according to the needs today. Solid state reaction has been used as a very common technique to develop phosphor either at laboratory level or commercial level, but there is a remarkable shift in the paradigm with the advent of nanotechnology which is now driving the industry forward towards an unknown and unprecedented phase, where the small is gaining and the big losing literally. Nanometer-sized phosphor powders exhibit good spectroscopic properties that are different from their micrometer sized counterparts. Generally, the observed luminescence in nano crystalline materials has been explained using two arguments: luminescence is dominated by quantum confinement effects and luminescence is dominated by defect interactions and chemical species[1]. For the last one and half decade the nanotechnology, with size limitation of less than 100nm, has been moving at a pace and gaining momentum, research in this field is becoming more and more active [2,3]. In this regard the phosphor research has also awakened to

the challenge and new and better materials with the size limitations are being pursued rigorously. A number of publications have appeared on the same and the effect on the size with the effect on the optical property has been a topic of great interest today. The goal of this research effort was to develop a comprehensive understanding of the factors that affect the luminescence behavior and study the optical properties of synthesized by using combustion method nano crystal phosphors with crystallite sizes less than 100nm. The combustion process is self-propagating i.e., once ignited it goes to completion without the supply of additional heat from an external source. The resulting powder was very soft and white in colour.

2. Experimental

The Sr_2CeO_4 phosphor is prepared by combustion synthesis technique. The combustion process is self-propagating i.e., once ignited it goes to completion without the supply of additional heat from an external source. The resulting powder was very soft and white in colour. The materials in preparation of sample were $Sr(NO_3)_3$, $Ce(NO_3)_3$,$6H_2O$ and the fuels used for the combustion synthesis are urea and citric acid. The stoichiometric ratio of Sr:Ce was kept at 2:1. All the materials of 99% used for the synthesis. Phase identification of the powders was carried out by the X-ray powder diffraction using RIGAKU D'MAX III Diffractometer having Cu K_α radiation (λ =1.54nm). The scan range was kept from 5 degrees to 80 degrees at the scan speed of 0.05 degree per second. The photoluminescence [PL] emission and excitation spectra were recorded at room temperature using spectrofluorophotometer RF-5301 PC of SHIMADZU make. The source is a xenon lamp. The slit width for the emission and excitation was kept at 1.5nm for all the measurements. A filter was used to remove the second order peak of the excitation light in the PL measurements.

3. Results and Discussions

The figure-1 shows the XRD pattern of the samples using combustion technique synthesized, and the curves A, B and C stands for samples heated at 800, 1000 and 1200°C respectively. It reveled that the phase formation of the compound when synthesized by the combustion method at 1200°C is the most pure state and matching with the literature [4-6].The crystal structure of Sr_2CeO_4 was found to be orthogonal by using Scherrer equation. The average crystallite size comes out to be 45nm for the 1200^0C prepared by combustion technique. The formation of nano crystallite size from the combustion is a desired property.

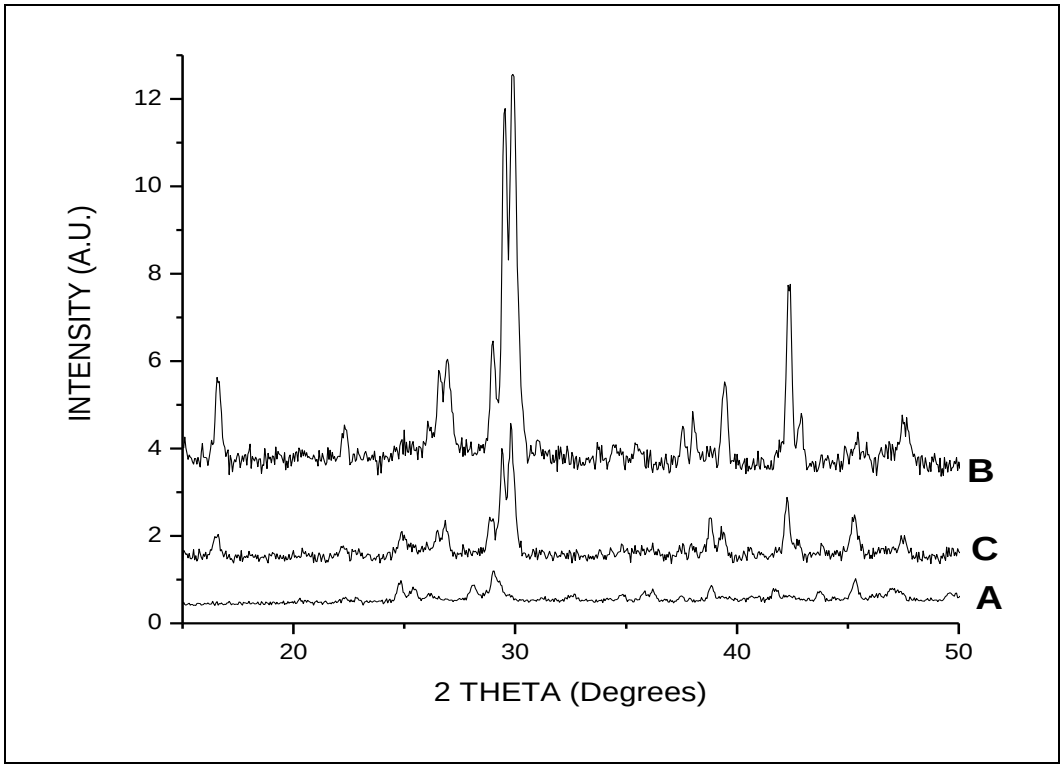

Figure-1 XRD Patterns of the samples A, B and C

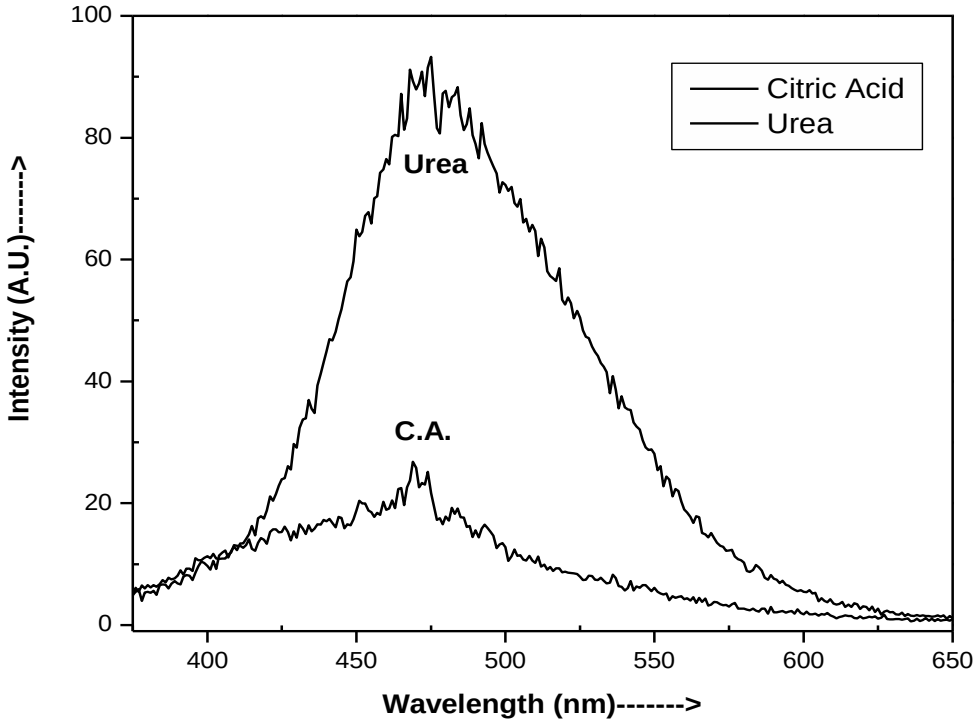

Figure-2 The photoluminescence emission spectra of sample with different fuels monitored at 254nm excitation wavelength.

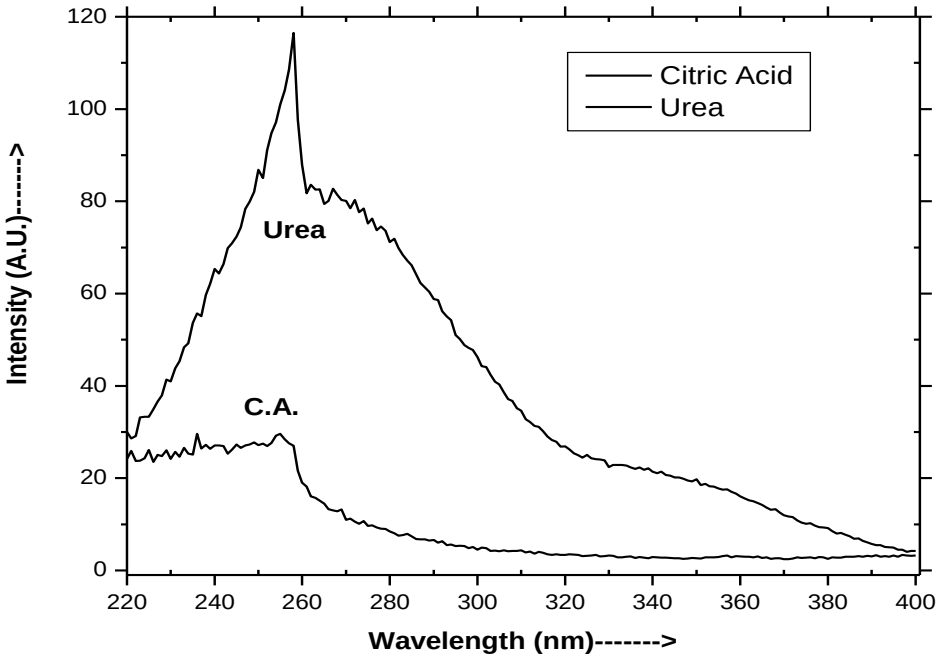

Figure-3 The photoluminescence emission spectra of the sample with different fuels monitored at 472nm excitation wavelength.

The luminescent measurements were carried out in identical conditions. The figure-2 and 3 shows the photoluminescence emission and excitation curves of combustion synthesized Sr_2CeO_4 sample for different fuels, urea and citric acid, when excited with 254nm and 472nm respectively. It is found that the intensity of the curve with citric acid is very low in comparison to the urea, this may be due to the fact that the adiabatic flame temperature when the combustion takes place are not high enough for the reaction to fully take place when the citric acid is used as fuel. This hinders the reaction mechanism and hence the less luminescence intensity, the product may also be with traces of the unreacted starting material.

4. Conclusions

The results shows that the powder samples of Sr_2CeO_4 prepared by the combustion technique exhibits high homogeneity, more uniformity.The photoluminescence intensity at room temperature increases as the firing temperature was increased from 800 to 1200^{o}C. The crystal structure of Sr_2CeO_4 was found to be orthogonal. The average crystallite size comes out to be 45nm for the 1200^{0}c reported. The combustion synthesized sample shows the formation of nano sized particles. Experimental results show that this phosphor can be a suitable for field emission displays as well as in fluorescent lamps

Acknowledgements

The authors would like to thanks University Grant Commission, New Delhi, for providing financial grant under Faculty Development Programme (FDP).

References:

[1].Graeve,O.A.,Varma,S.,RojasGorge,G.,Brown,D.R.,E.A.Lo Ceram.Soc.,89,(3), (2006), 926–931.

[2].Chinie,A.M..,Stefan,A..,Georgescu,S..,Romanian Reports in Physics, 57, 3, (2005),412-417.

[3]. Wakefield,G.,Keron,H.A..,Dobson,P.J.,Hutchison,J.L., Journal of Colloid and Interface Science,215,(1999),179-182.

[4]. Xing,D..,Shi, J., Mat. Lett.,59,(2005),948.

[5]. Chen, S., Chen,X.., Yu,Z..,Hong, J..,Xue, Z. Solid State Communications, 130,(3-4), (2004),48-50.

[6]. Ekambaram,S., Patil, K.C ., Maaza, M., Journal of Alloys and Compounds, 393,(2005), 81–92.