International Journal of Luminescence and its applications
Volume 3(II), July, 2013, ISSN 2277 – 6362

Synthesis and PL Study of Sr_2CeO_4: Sm Phosphor

B.Nageswara Rao[1], B.Walter Ratna Kumar[2], Dr. B.subba Rao[3]
[1]Visvodaya Govt. degree College,Venkatagiri, [2]P.B.N.College, Nidubrolu-522124, [3] V.S.R.&N.V.R. College, Tenali-522201,

Abstract

At present there has been growing interest in the development rare earth doped phosphors as they are having highly efficient in luminescence properties for the commercial appplications such as Fluorescent Lamps, Cathod Ray Tubes, Field Emiting Diodes,etc. The present paper reports the Synthesis and Photoluminescence study of Sr_2CeO_4 doped with Sm ions in different concentrations. The Samples were successfully synthesized using Solid State Reaction method by increasing the Sm concentration from 0.01,0.1,0.2, 0.5, and 1 mol% . The X-ray diffraction pattern reveals that they are in single phase. Fig.1 is the excitation and emission spectra of Sr_2CeO_4 : Sm,which showsa broad emission in entire visible region from blue to red . 470nm emission peak due to transition of Ce,small emission peaksat568nm and 611nm dueto transition of Sm were observed.

Keywords: XRD, SEM, Photoluminescence, Phosphor, Solid state reaction

1.0 INTRODUCTION

The phosphor research has taken a great shape and need of the hour to revolutionize the synthesis techniques and modify them according to the needs of today. Solid state reaction has been used as a very common technique to develop phosphor either at laboratory level or commercial level. Nano material phosphor powders exhibit good spectroscopic properties that are different from their micro meter sized counter parts. The goal of this research effort has to develop a comprehensive understanding of the factors that affect the luminescence behavior and to study the optical properties of synthesized nano crystal phosphor with crystallite size less than 100nm.

EXPERIMENTAL

Strontium nitrate and Cerium nitrate along with Urea (high purity chemicals) were used as starting materials for preparation of blue phosphor (Sr_2CeO_4)and added them as a stoichiometric proportions of Sr:Ce as 2:1. They were weighed and taken into agate mortar and pestle was mixed, grinded thoroughly to get fine powder. The compound obtained was fired at 1200^0C in a muffle furnace for 3 hours .The same procedure was followed to prepare Sm doped Sr_2CeO_4 phosphor.The concentration of Sm was varied respectively as 0.01, 0.1, 0.2, 0.5 and 1%. Photoluminescence spectra were recorded at room temperature using Spectrofluorophotometer using Xenon lamp as excitation source at M.S.U, Baroda. SEM and XRD were taken at RRCAT, Indore.

RESULTS AND DISCUSSIONS

PL Study: The excitation spectrum of Sr_2CeO_4 sample shows peaks at 248, 254 and 267 nm. for the emission at 470 nm., a perfect blue region with very good intensity. However, the affect of Sm, Eu dopants effectively modified the emission wavelengths of pure phosphor, but the intensity was decreased. The figure is the excitation spectrum along with emission spectrum which shows peaks at 470, 568 and 611 nm. for 254 nm excitation. The peak aroud 360nm is due to crystal field of the Phosphor.

The broad band is due to $^4f \rightarrow ^5d$ (t_{1g}) transition of ce^{4+}, which is very strong and energetic.
The peak 568nm is due to $^4G_{5/2} \rightarrow ^6H_{9/2}$ transition of samarium.
The peak 611nm is due to $^4G_{5/2} \rightarrow ^6H_{7/2}$ transition of samarium.

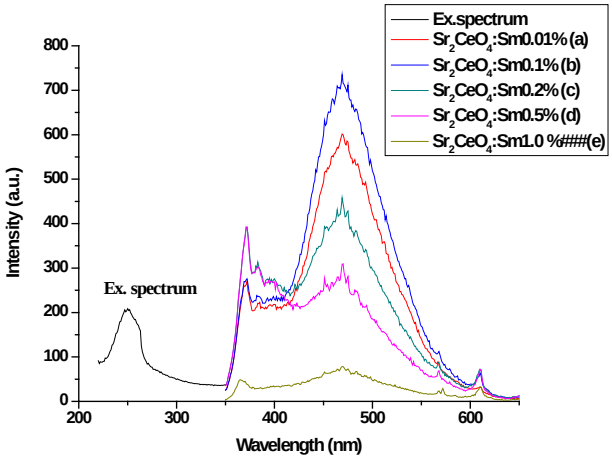

Fig. 1: Excitation & Emission spctra of Sr_2CeO_4 :Sm at 254nm Ex.

XRD: The XRD pattern shows the formation of majority single phase Sr_2CeO_4 compound and is well matched with the JCPDS data.

SEM:

References:

[1] Pallavi Page and K.V.R. Murthy, Philosophical Magazine Letters, Vol. 90, No. 9, September (2010), 653–662.

[2] W.M.Yen, S. Shionoya and H. Yamamoto, Phosphor Handbook, CRC Press, Boca Raton, FL (USA) 2007.

[3] Pallavi Page, Rahul Ghildiyal and K.V.R. Murthy, Materials Research Bulletin, 43(2008) 353-360.

[4]H. Chnader, Mater. Sci. and Eng. R49 (2005) 113.