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RESEARCH ARTICLE

SYNTHESIS AND PHOTOLUMINSCENCE OF EU^{3+} ACTIVATED SULPHATE HOST PHOSPHORS

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ABSTRACT

$CaSO_4$: Eu^{3+} phosphors prepared by co-precipitation method have been studied for its photoluminescence characteristics. The $CaSO_4$ phosphors are prepared by doping different concentration of Europium (1,3,5 mole %). The sample shows maximum peak intensity for 5 % doping of Europium .The excitation at 254 nm and emission at 615 nm of photoluminescence was investigated.

INTRODUCTION

Rare earth doped alkaline earth sulphate received attention for application in various areas (Lakshmanan, 2001) of the several sulphate. Rare earth doped $caso_4$ is studied extensively for the possible applications as phosphor for photoluminescence crystal liquid display (PLLCD) optical storage material. Several studies have been made with regard to control of particle size and morphology of $caso_4$ (Sahare *et al.*, 2010 and OzA *et al*., 2012). Rare earth doped caso4 is also used in radiation dosimetry so that rare earth doped (RE) doped caso4 phosphor continue to receive attention of research workers. As early as 1955 as doped $caso_4$ was shown to have useful properties for applications in TL dosimetry of iodizing radiations. The rare earth (RE) doped anhydrites were also studied by several workers (Danby, 1988 Daniela Freyer and Wolfgang Viogt, 2003) photoluminescence in caso4: Eu^{3+}.

Later moharil, *et al*. (Dhopte, 1991 Patil, 2006) gave recipe for preparing caso4:Eu phosphors with Eu in predominantly Eu^{3+} form and used these phosphors for establishing the mechanism of TL in $caso_4$: RE systems. Recently Lapraz *et al*. (Lapraz, 2000) have also presented work on these aspects. They also reported cathode luminescence in $Caso_4$:Eu and found suitable for applications in photoluminescence liquid crystal display. We studied photoluminescence of $caso_4$: Eu phosphor and results are presented in this paper.

Experimental

$CaSO_4$: Eu^{3+} phosphors co-precipitation method Eu_2O_3 was dissolved in dilute HNO3 then slowly evaporated to get Europium nitrate. This fresh prepared Europium nitrate and calcium nitrate $(CaNO_3)_2.4H_2O$ were dissolved on double distilled water. This solution was precipitate by concentrated H_2SO_4. Repeatedly washed and dried the precipitate at 100^0C for 1 hour in an oven. The dried sample was annealed in air at 920^0C for 1 hour and quenched on thin aluminum block at room temperature. Starting material with their molar ratio as shown in

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Table 1. prepared for Europium nitrate and calcium nitrate

CaSO4: Eu^{3+}	$Ca(NO_3)_2$	$Eu(NO_3)_2$
Molar ratio	0.95	0.05
Weight in gram	2.2434	0.175

The Photoluminescence of various samples were studied on a Hitachi F-7000 fluorescence spectrometer Emission and excitation spectra were recorded using a spectral slit of 1.5nm. The XRD data of prepared $CaSO_4$: Eu^{3+} phosphors matched well with standard data of JCPDS (ICDD file No-72-0916)

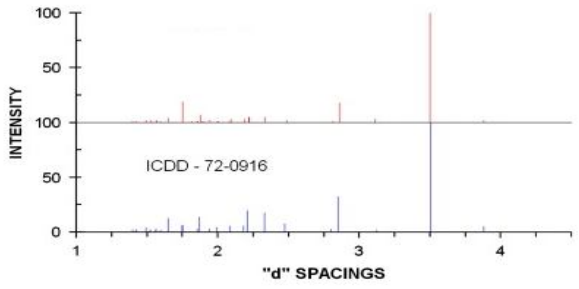

Fig.1. XRD pattern of CaSO4 (upper pattern is our work and lowers is ICDD file)

RESULT AND DISCUSSION

The $CaSo_4$:Eu^{3+} phosphors is successfully prepared by co-precipitate method and conform by XRD pattern. Also the spectroscopic investigation and photoluminescence spectra of Europium activated sulphate based samples has been studied. Excitation and emission Spectra of $CaSo_4$ doped with different concentration (1%,3%,5%)of Eu^{3+} and PL of sample recorded at room temperature is shown in Fig (3)

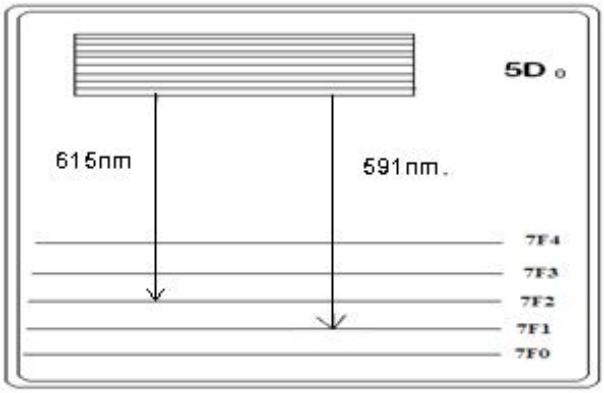

Fig. 2. Energy Level Diagram of CaSo4:Eu^{3+} Phosphor

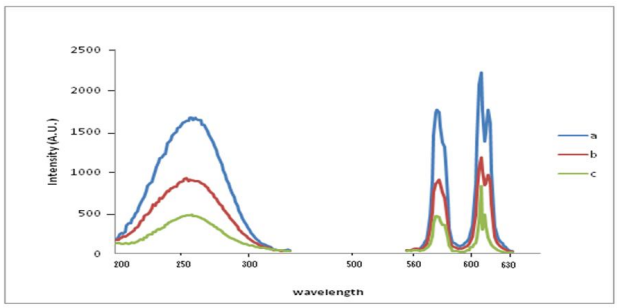

Fig.3. PL Excitation Spectra of $CaSo_4$:Eu^{3+} Monitored at 615 nm for (a) 5% (b) 3% (c) 1% and Emission recorded at 254nm for (a) 5% (b) 3% (c) 1% respectively

The excitation spectra monitored for λ emission 615nm showing broad excitation over 238nm-260nm peaking intense around 254nm with strong UV absorption. While emission spectra recorded for 254 nm excitation shows two peaks one observed at 591nm and other peaking around at 615nm with small shoulder peak in Eu^{3+} to best of our spectroscopic study revealed that 591 nm ,615 nm peak is arises due to transition of 5D0 →7F1 and of 5D0 →7F2.

The weak Shoulder peak which is unwanted can be suppressed by adopting some optical quenching or specific heating treatment. The Prepared sample of$CaSo_4$:Eushows strong UV absorption and emission at intense red emitting phosphor could be suitable LED based solid state lighting and other display devices.

Conclusion

The CaSo4:Eu^{3+} phosphor shows maximum intensity and phosphor is found suitable for ultraviol*et a*bsorption. It is also observed that CaSo4 detector doped with Europium is appropriate for dosimetric purposes. Future techniques for preparation of the described composites as well as other radiation sources for testing the pellets could be within the scope of future work.

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