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Synthesis and Characterization of $Sr_2Y_2Al_2O_8$: Eu phosphor

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Abstract *- $Sr_2Y_2Al_2O_8$ doped Europium ion was synthesized by solid state reaction under air atmosphere. Its characterization was systematically analyzed by SEM, X-ray diffraction (XRD) and photoluminescence spectra (PL). Photoluminescence emission spectra having an excitation 273 nm at around 254, 265 nm revealed that Eu ions were present in trivalent oxidation states. The emission peaks are found at 534, 593, 617nm (green), and 612nm (red) are observed. Scanning Electron Microscopy (SEM) was implemented to investigate the surface morphology of present phosphor. The obtained results on $Sr_2Y_2Al_2O_8$: Eu is suitable for green-red light source using UV light as the primary excitation.*

1. INTRODUCTION

Ever demand for new and tough operating display device phosphors zeroed the Strantium compounds have been utilized as host materials of lamp phosphors for many years, thanks to their relatively low material cost, and reasonable stability in lamp application. The development of the first synthesized aluminates phosphor can be traced back to 1970. In the 1980's rare-earth-activated aluminate phosphors were practically used in (BAM:Eu) fluorescent lamps. This was the first application of rare-earth-activated aluminates in tri band fluorescent lamps and represented a landmark in this history of fluorescent lamp development.

2. EXPERIMENTAL

To prepare Strontium Yittrium Lanthanate ($Sr_2Y_2Al_2O_8$) doped with various concentrations of Europium, consists of heating stoichiometric amounts of reactants at 1000 °C for 2 h in a muffle furnace. The Eu^{3+} activated ASL phosphor was prepared via high temperature modified solid state diffusion. The starting materials were as follows: Aluminum Oxide, strontium carbonate , Lanthanum Oxide and the molar ratio of rare earth terbium oxide and Eu_2O_3 (National Chemicals, Baroda, 99.999%) was used to prepare the phosphor .The mixture of reagents was ground together to obtain a homogeneous powder in acetone base. After being ground thoroughly in stoichiometric ratios by using an agate mortar, to ensure the best homogeneity and reactivity, powder was transferred to alumina crucible, and then heated in a muffle furnace at 1200 °C for 2 hr. The phosphor materials were cooled to room temperature naturally. All samples were found out to be white who are studied for photoluminescence. PL spectra were recorded at room temperature using SHIMADZU spectrofluorophotometer.

3. RESULTS AND DISCUSSION

Figure-I is the PL of $Sr_2Y_2Al_2O_8$:Eu excited with 254, 265nm. The main PL peaks are observed at 534, 593, 612 and 617nm with different intensities. However the green emission intensity at 617nm dominates all other emissions followed by 534, 593 and 617nm. All the observed peaks are allowed transitions of Europium when excited with 254nm. The observed some main peaks and other small peaks are basically the allowed transitions of europium in +3 state. They are due to:

1. 515nm emitted peak is due to $^5D_2 \rightarrow {}^7F_3$ transition of Europium and is due to electric dipole with energy 2.429 eV.
2. 540nm emitted peak is due to $^5D_1 \rightarrow {}^7F_1$ transition of Europium and is due to electric dipole with energy 2.307 eV.

3. 626nm emitted peak is due to $^5D_0 \rightarrow {}^7F_3$ transition of Europium and is due to electric dipole with energy 1.985 eV and is due to electric dipole.

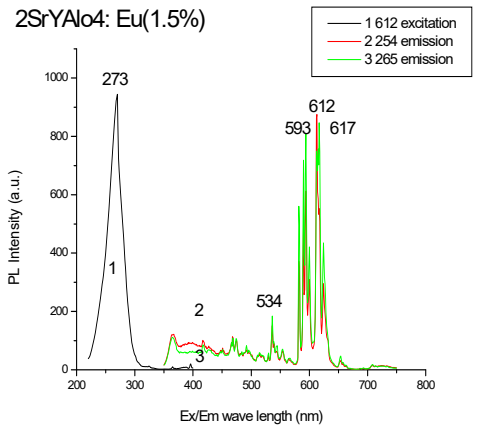

Figure-I: Excitation and emission spectrum of **$Sr_2Y_2Al_2O_8$**:Eu(1.5%) phosphor Figure-I is the PL of **$Sr_2Y_2Al_2O_8$**:Eu

3.1 SEM STUDY

The morphological investigation of Eu doped **$Sr_2Y_2Al_2O_8$** was carried out by scanning electron microscopy (SEM). The typical SEM image is shown in Fig. 2. SEM image reveals that the particles size and shape is irregular and size varies from 1-4µm with highly agglomerated particles are present in the phosphor.

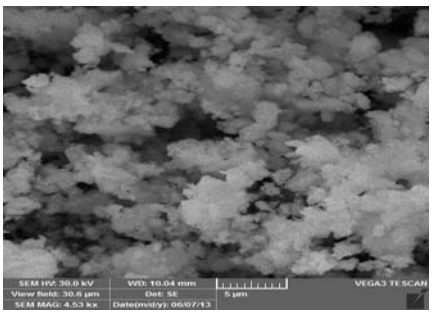

Fig.2: SEM of $Sr_2Y_2Al_2O_8$:Eu (1.5%)

CONCLUSIONS

The emission peaks observed in **$Sr_2Y_2Al_2O_8$**:Eu when excited with 254, 265 nm at 534, 593, 617nm(green), and 612nm(red) are observed. As excitation wavelength the observed peak intensities are increased. However it is interesting to note the lesser the excitation energy the more PL output for 617nm peak whose intensity is more than 300% when compared the 254 vs 265nm excitations. The obtained results on **$Sr_2Y_2Al_2O_8$**: Eu phosphor is suitable for green-red light source using UV light as the primary excitation.

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