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Fluorescence Study of Sm Doped Barium Magnesium Aluminate Phosphor

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ABSTRACT – $\text{BaMgAl}_{10}\text{O}_{17}$: Sm doped phosphor prepared by combustion method without citric acid with different concentration. The 2 % Sm doped phosphor exhibit good emission at the excitation of the material with 254 nm wavelengths generates a strong emission at 367, 470, 730 nm. Besides this, subsidiary maxima at 401, 451, 484 and 497 nm wavelengths in violet region are discernible with dispersion towards green region.

Keywords : $\text{BaMgAl}_{10}\text{O}_{17}$: Sm; phosphor; combustion method; emission

I. Introduction

The fluorescence examination of phosphors brings out number of information and throw light on the use of materials as fluorescent lamp phosphors^(1-6,7). The well known phosphors developed are $\text{BaMgAl}_{10}\text{O}_{17}:\text{Eu,Ce}$, $\text{Ca}\{\text{Po}_4\}\text{F Cl} : \text{Sb, Mn, LaPO}_4 : \text{Tb, LiYF}_4:\text{U}^{4+}$, $\text{BaMgAl}_{10}\text{O}_{17}:\text{Mn}$, $\text{LaPO}_4 : \text{Ce}$ and aluminates in mono, dia and tri-valent doped forms. In present paper, the emission and excitation spectra of synthesized phosphors have been recorded at room temperature. The emission spectra have been examined for the number of RE activated BaMg-aluminates and the characteristic spectra are presented for discussion. The emission band is specified by the wavelength at which its peak appears. Some times, changes in the relative intensities of the component within a composite band would give rise to apparent shift in the position of its maximum. In that cases, the standard emission /excitation positions have been mentioned. The intensities of the emission as well as excitation bands are given in absolute units.

II. Experimental

The specimen of $\text{BaMgAl}_{10}\text{O}_{17}$ doped Sm have been prepared by solid state reaction and combustion method by with and without citric acid with different concentration⁽⁵⁾. The appropriate oxides were thoroughly ground and fired at 1140°C for four hours. The specimens thus obtained have been characterized through

standard XRD technique. Fluorescence excitation and emission spectra was recorded at room temperature by RF- 5301 PC Spectrophotofluorometer described elsewhere. In present work, the excitation and emission spectra of synthesized phosphors have been recorded at 64 % humidity and at room temperature. I.e.

III. Result and discussions

The excitation spectra of $\text{BaMgAl}_{10}\text{O}_{17}:\text{Sm}$ (2 %) phosphor is shown in Fig.1. It represents emission band at 254, 360, 630, 585 and 695 nm wavelengths.

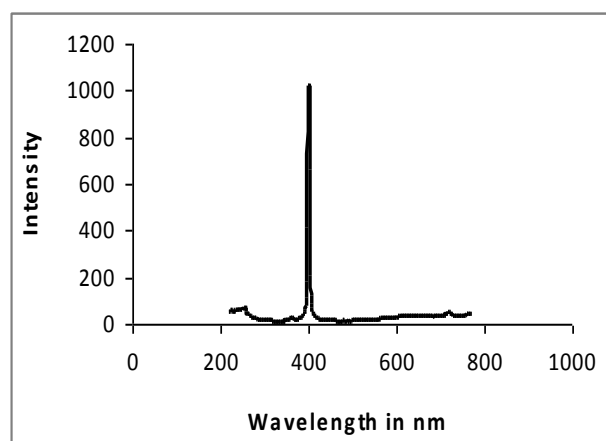


Fig. 1. Excitation spectra of $\text{BaMgAl}_{10}\text{O}_{17}:\text{Sm}$ (2 %) with Excit. at λ_{400} nm.

Fig.2. represents emission spectra of BaMg aluminate doped Sm on excitation at 254 nm wavelength exhibits 470 (blue) and 729 (Red) nm wavelengths.

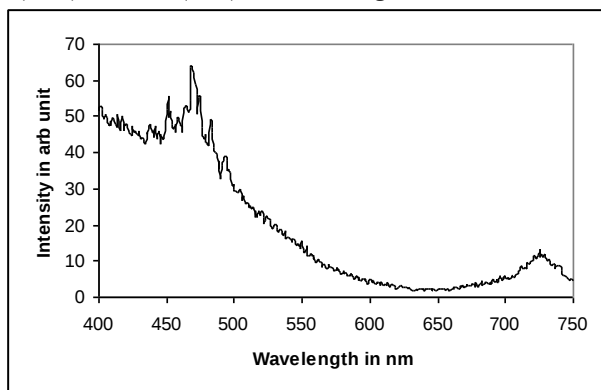


Fig.2. Emission spectra of BaMgAl₁₀O₁₇ : Sm (2 %) with Excit. At λ_{254} nm.

Fig.3. shows emission spectra of BaMgAl₁₀O₁₇: Sm (2 %) at excitation of 360 nm wavelength it exhibits 422 and 721 nm wavelengths with small emission band at 470 nm wavelength.

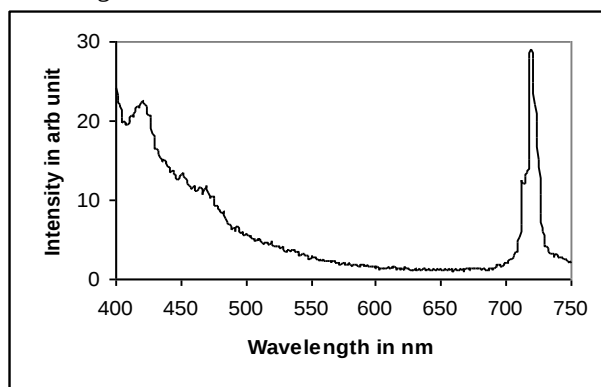


Fig.3. Emission spectra of BaMgAl₁₀O₁₇ : Sm (2 %) with Excit. at λ_{360} nm.

But same phosphor is excited at 630 nm wavelength it gives emission bands with high intensity peak at 470, 585 and 635 nm wavelengths along with 453, 494, 529 and 701 nm wavelengths as shown in **Fig. 4.**

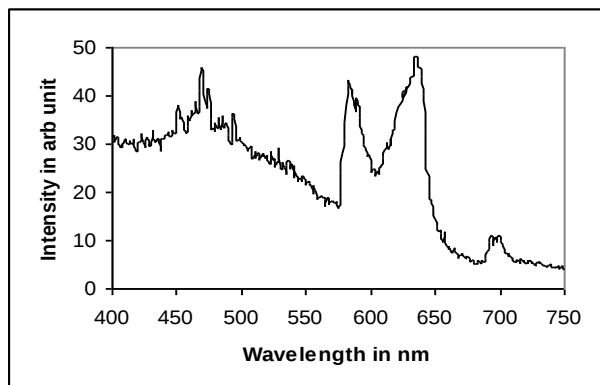


Fig.4. Represents emission spectra of BaMgAl₁₀O₁₇ : Sm (2 %) with Excit. at λ_{630} nm.

Fig.5. represents emission spectra of BaMgAl₁₀O₁₇: Sm (2 %) with excitation at 585 nm wavelength. It exhibits three high intensity emission peaks at 470, 587 and 693

nm wavelengths and 486, 497 and 630 nm with less intense peaks.

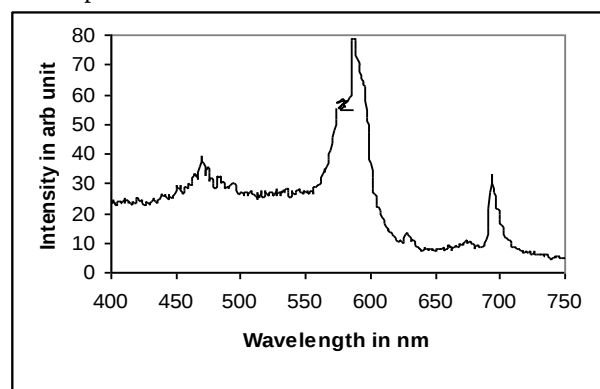


Fig.5. Emission spectra of BaMgAl₁₀O₁₇ : Sm (2 %) with Excit. at λ_{585} nm.

BAM synthesized by solid state reaction method were excited at 695 nm, it exhibits two isolated peak at 470 and 700 nm wavelengths along with small peaks at 453 and 495 nm wavelengths as shown in **Fig.6.**

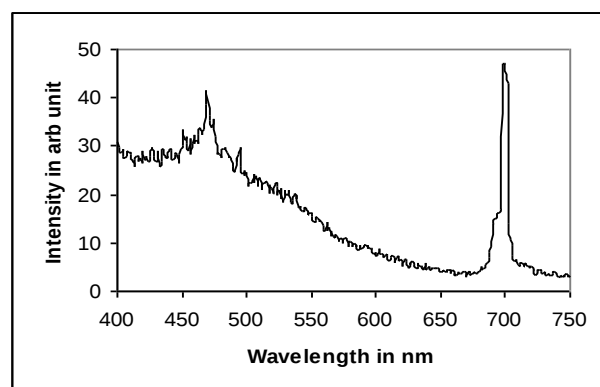


Fig.6. Emission spectra of BaMgAl₁₀O₁₇ : Sm (2 %) with Excit. at λ_{695} nm.

The synthesized phosphor made by combustion method without citric acid was excited at 254 nm wavelength. It exhibits two well isolated and more intense emission peak at 470 (Blue) and 721 nm (Red) wavelengths and one small intense peak at 585 nm (yellow) wavelength as shown in **Fig.7.**

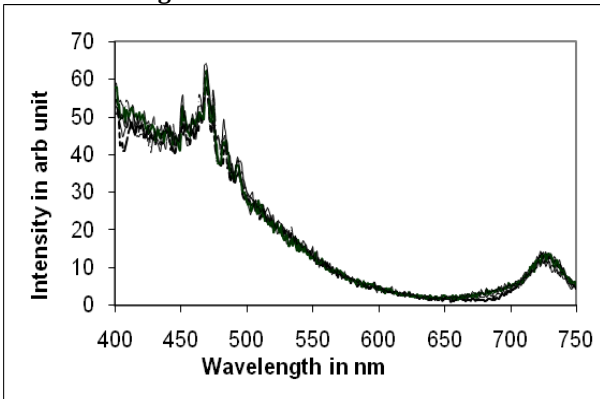


Fig. 7. Emission spectra of BaMgAl₁₀O₁₇ and BaMgAl₁₀O₁₇ : Sm (2 %) with Excit. at λ_{254} nm Combustion without citric acid (.....)

pure BAM, (---)BaMgAl₁₀O₁₇: Sm (.25%), (-.-.-.-)BaMgAl₁₀O₁₇: Sm (.5%), (_ _ _ _) BaMgAl₁₀O₁₇: Sm (1%) and (____)BaMgAl₁₀O₁₇: Sm (2%)

The phosphor prepared by combustion method without citric acid was excited at 585 nm wavelength of BaMgAl₁₀O₁₇: Sm (0.5 %) BaMgAl₁₀O₁₇: Sm (1 %) and BaMgAl₁₀O₁₇: Sm (2 %) exhibit only one sharp emission band at 585 nm (Yellow colour) wavelength but the phosphor of pure (BAM) BaMgAl₁₀O₁₇ and low concentration of Sm impurity [BaMgAl₁₀O₁₇: Sm (0.25 %)] does not exhibit 585 nm emission band as shown in Fig.8.

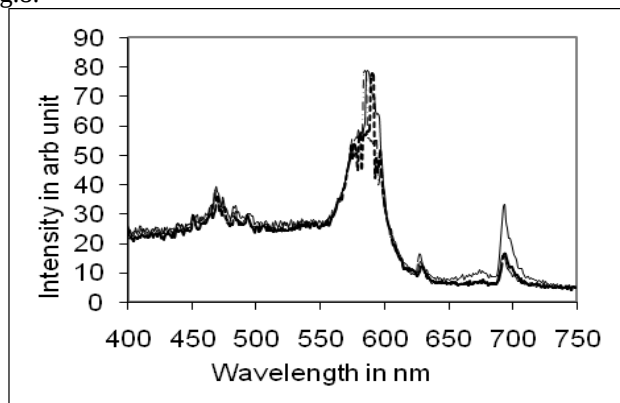


Fig. 8. Emission spectra of BAM doped Sm with Excit. at 400 nm of different concentrations BaMgAl₁₀O₁₇: Sm (0.5 %) (.....), BaMgAl₁₀O₁₇: Sm (1 %) (-.-.-.-), BaMgAl₁₀O₁₇: Sm (2 %) (____) of phosphor prepared by Combustion method without citric acid.

IV. Conclusion

Sm³⁺ activated BaMg-aluminates are found good Yellow -emitting phosphors. The phosphor can be used for compact fluorescent lamp for the protection from insects.

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