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Fluorescence and Thermoluninescence (TL) studies of Ce doped $BaMgAl_{10}O_{17}$ phosphor

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Published on 30 June 2012

ISSN 2170-1237

Journal of Scientific Research

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ISSN 2170-1237

Journal of Scientific Research

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FLUORESCENCE AND THERMOLUNINESCENCE (TL) STUDIES OF Ce Doped $BaMgAl_{10}O_{17}$ PHOSPHOR

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Abstract – *In the present paper reports Barium Magnesium Aluminates doped Ce is synthesized by solid state reaction. Fluorescence study of Ce doped $BaMgAl_{10}O_{17}$ phosphor exhibit the excitation of the material with 317nm wavelengths generates a strong emission at 676 nm in far infrared region. Thermoluminescence glow curves were carried out on phosphor of gamma irradiated Ce doped $BaMgAl_{10}O_{17}$. The $BaMgAl_{10}O_{17}$: Ce phosphor irradiated (10^5R) exhibits two well defined peaks at 230°C and 330°C along with hump at 140 °C temperature are observed, the first being the intense one and well defined than other peak.. These changes are may be possible due to electronic charges and sizes of these added impurities.*

Keywords: *$BaMgAl_{10}O_{17}$, Ce; phosphor; Fluorescence; Thermoluminescence; Peaks*

I. Introduction

The fluorescence examination of phosphors brings out number of information and throws light on the use of materials as fluorescent lamp phosphors. In present paper, the excitation and emission 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.

Thermoluminescence radiation dosimetry (TLD) is a very good technique of research in luminescence field. Many researchers have done tremendous work in this field to establish new TLD phosphors [(1)]. The well known phosphors developed are $LaPO_4$: Tb, NaCl: Ca, Ca{Po_4}F Cl : Sb,Mn, NaCl: Tb, $LiYF_4$:U^{4+}, $CaSO_4$:Dy, $LaPO_4$: Ce: Tb and aluminates in mono-,dia and tri-valent doped forms [(1-8)]. The present paper TL-properties of $BaMgAl_{10}O_{17}$ doped with impurities Ce have been examined in order to investigate the effect of impurities on TL- behavior of BaMg-aluminates and to find out the peak suitable for dosimetric application. The phosphor can be used for compact fluorescent lamp for the protection from insects

.

II. Experimental

The phosphor of Ce doped with $BaMgAl_{10}O_{17}$ have been synthesized by solid state reaction [(9)]. The appropriate oxides were thoroughly ground and fired at 1200°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 **Hitachi' model F-4500 system** described elsewhere. Thermoluminescence glow curves were recorded at room temperature by using standard experimental set-up described elsewhere. The fluorescence excitation / emission spectra and TL glow curves are recorded at room temperature and are presented in the figure 1, 2 and 3.

III. Result and Discussions

Figures 1 & 2 respectively exhibit the excitation and emission spectra of $BaMgAl_{10}O_{17}$:Ce phosphor.

It indicates that the excitation of the material with 317nm wavelengths generates a strong single emission peak at 676nm in far infrared region.

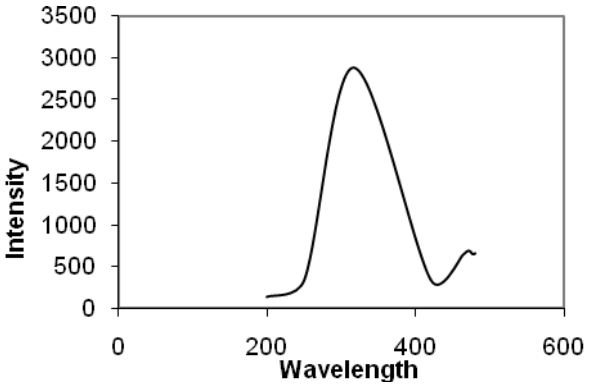

Figure 1. Represents excitation spectra of Ce doped BaMg-aluminates.

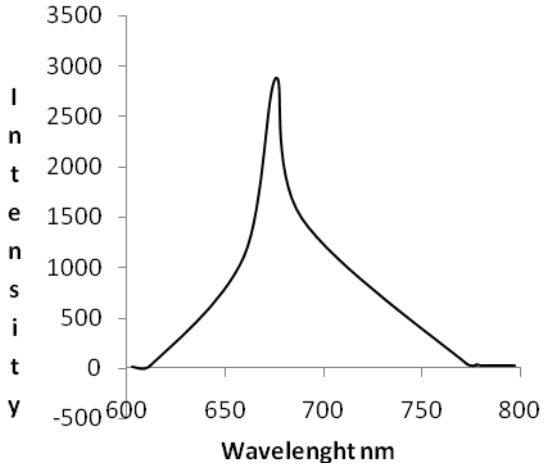

Figure 2. Represents emission spectra of $BaMgAl_{10}O_{17}$: Ce with excitation at 317 nm.

The glow curves of the Ce doped BaMg aluminates have been recorded for temperature range 25° to 400°C with uniform heating rate (300°C/min), under influence of three standard gamma doses10^5R..The speed of X-Y recorder was 1 mv/cm. Figure 2 respectively exhibit the TL glow curve observed in Ce activated $BaMgAl_{10}$ O_{17} phosphors.

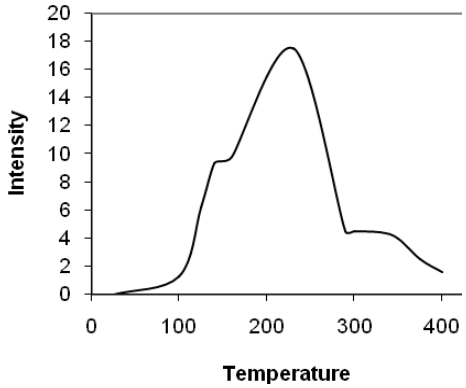

Figure 3. Represents TL glow curve of Ce doped $BaMgAl_{10}$ O_{17}

It is observed that develops phosphor irradiated with 10^5R exhibits a strong peak at 230°C and humps on ascending and descending sides of it around 140°C and 330°C respectively. The 230°C peak seems to be the properly of Ce impurity in BaMg aluminate. The trap parameters viz.: activation energy (E), frequency factor (S) are determine by different heating rates method and order of kinetics are determine by peak shape method for the prominent peak are given in Table 1.

Peak Temp (°C)	Activation energy (E) (eV)	Frequency Factor (S) Sec^{-1}	Order of Kinetics 1^{st} order	Probability (ρ) Sec^{-1}
140	1.9	$9.7x10^{22}$	-	-
230	1.3	$3.1x10^{12}$	0.2	0.295
330	2.0	$1.6x10^{16}$	-	-

Table 1 Trap parameters

IV. Conclusion

The experimentally observed changes in TL properties of BaMg-aluminates can be explain on the promise of change in micro-electrical and mechanical fields in host lattice created due to differences in charge and sizes of impurities introduce in BaMg-aluminates. It is believed that the peak around 230°C in doped BaMg-aluminates is isolated, well defined and intense one, therefore it may be useful in TL- dosimetry. Detail and systematic dosimetric studies may strengthen the utility of these phosphors in radiation dosimetry.

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