SUMMARY

Of

MINOR RESEARCH PROJECT

On

"PHOTOLUMINESCENCE AND THERMOLUMINESCENCE STUDIES OF SOME INORGANIC PHOSPHORS"

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UNIVERSITY GRANTS COMMISSION

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The whole work initiated and completed may be divided into three sections.

Section 1. Review Work Based on Proposed Work.

Section 2. Experimental Work.

Section 3. Results and Applications.

Section 1. Review Work Based on Proposed Work:

At the initial stages of the project, intensive literature survey was done based on Luminescence Phenomenon, Phosphors, Thermoluminescence, Solid State Lighting and Phosphors for Solid State Lighting. From this literature review some unreported phosphors were found out and synthesized.

Section 2. Experimental Work:

The phosphors were synthesized by a simple wet chemical method. Samples were prepared by dissolving desired quantities of metal carbonates and Eu_2O_3 in halogen acid. Excess acid was then boiled off and the solutions were evaporated to dryness. The resulting mass was dried at 475 K for 2 h in air, crushed to fine powder and then annealed for 1 h at suitable temperature in a reducing atmosphere provided by burning charcoal so as to reduce the activator to divalent state. Thus prepared samples were analyzed for photoluminescence and thermoluminescence.

Section 3. **Results and Applications:**

- Prepared samples, viz. $Li_2MgBr_4:Eu^{2+}$, $Li_6MgBr_8:Eu^{2+}$, $RbSr_2Br_5:Eu^{2+}$, $Ba_2MgCl_6:Eu^{2+}$, $RbBa_2Br_5:Eu^{2+,}$ Rb_2ZnBr_4: Eu^{2+}, Rb_3ZnBr_5: Eu^{2+}, $Ca_5(PO_4)_3Cl:Eu^{2+}$, $KCaBr_3$:Eu and La_2O_2S:Eu.
- Carried out Photoluminescence and Thermoluminescence characterization of prepared phosphors.

<u>Photoluminescence:</u>

Following figures shows Photoluminescence spectra of some of the prepared phosphors and their analysis.

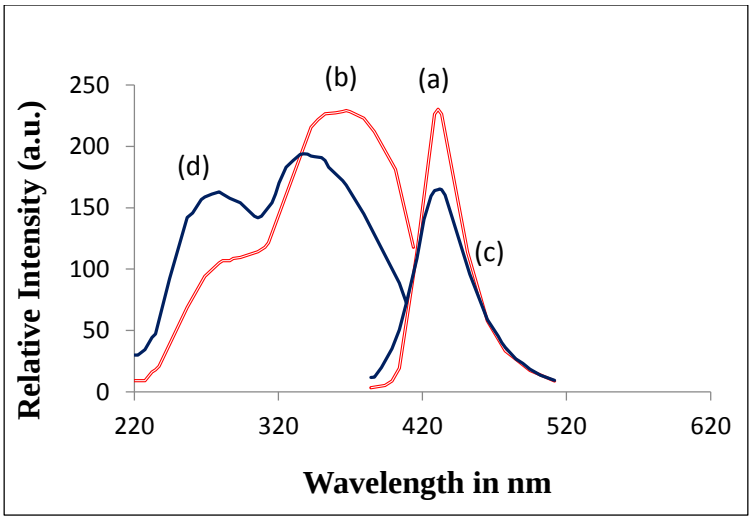

Fig. – ***PL spectra for $Li_2MgBr_4:Eu^{2+}$ & $Li_6MgBr_8:Eu^{2+}$***

a) Emission in $Li_2MgBr_4:Eu^{2+}$ for 365 nm excitation

b) Excitation for 430.8 nm, emission of $Li_2MgBr_4:Eu^{2+}$

c) Emission in $Li_6MgBr_8:Eu^{2+}$ for 365 nm excitation

d) Excitation for 430 nm, emission of $Li_6MgBr_8:Eu^{2+}$

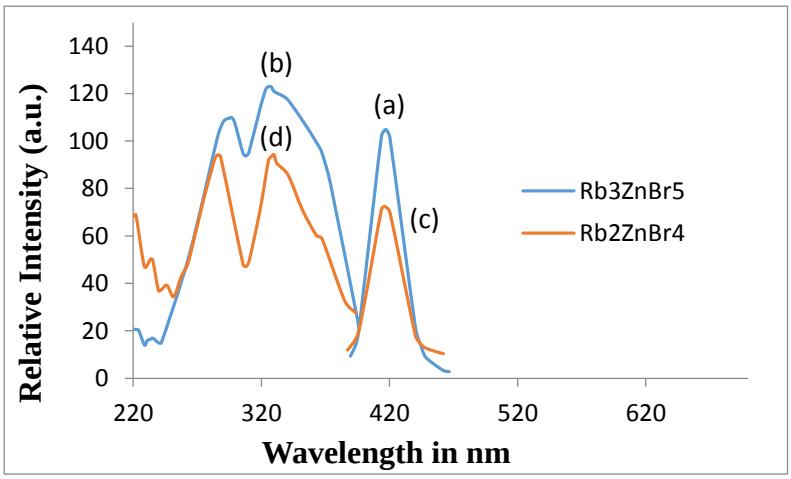

Fig. ***PL spectra for Eu^{2+} activated Rb_2ZnBr_4 and Rb_3ZnBr_5***

(a) Emission in $Rb_3ZnBr_5:Eu^{2+}$ for 365 nm excitation,

(b) Excitation for 420 nm emission of $Rb_3ZnBr_5:Eu^{2+}$,

(c) Emission in $Rb_2ZnBr_4:Eu^{2+}$ for 290 nm excitation,

(d) Excitation for 419 nm emission of $Rb_2ZnBr_4:Eu^{2+}$.

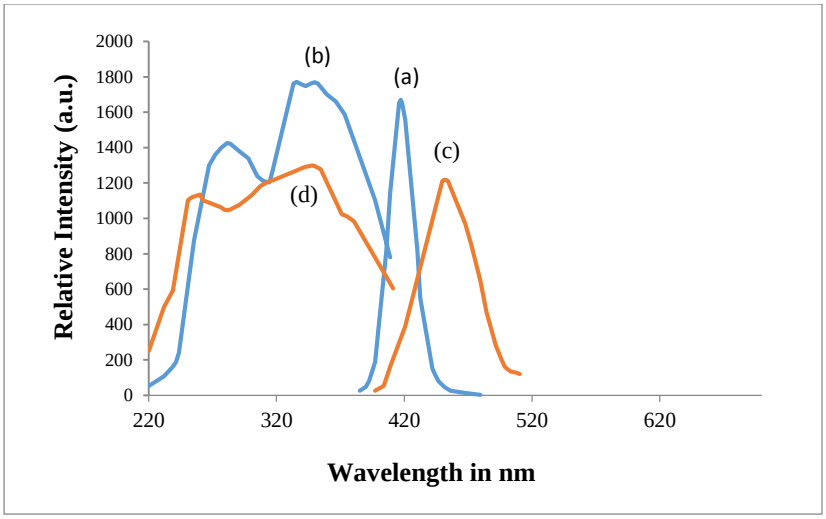

Fig. PL spectra for Eu^{2+} activated $RbSr_2Br_5$
(a) Emission in $RbSr_2Br_5:Eu^{2+}$ for 365nm excitation.
(b) Excitation for 417 nm, emission of $RbSr_2Br_5:Eu^{2+}$.
(c) BAM emission for 385 nm excitation.
(d) BAM excitation for 450 nm emission.

- Prepared phosphors are bright blue emitting phosphors and are the candidate for the blue colour for Solid State Lighting.

Thermoluminescence:

Following figures shows Thermoluminescence spectra of prepared phosphors.

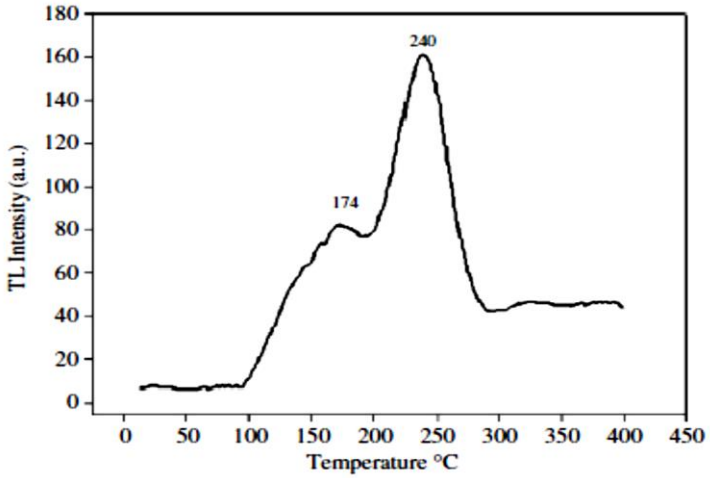

Fig. Thermoluminescence glow curve of $KCaBr_3:Eu$

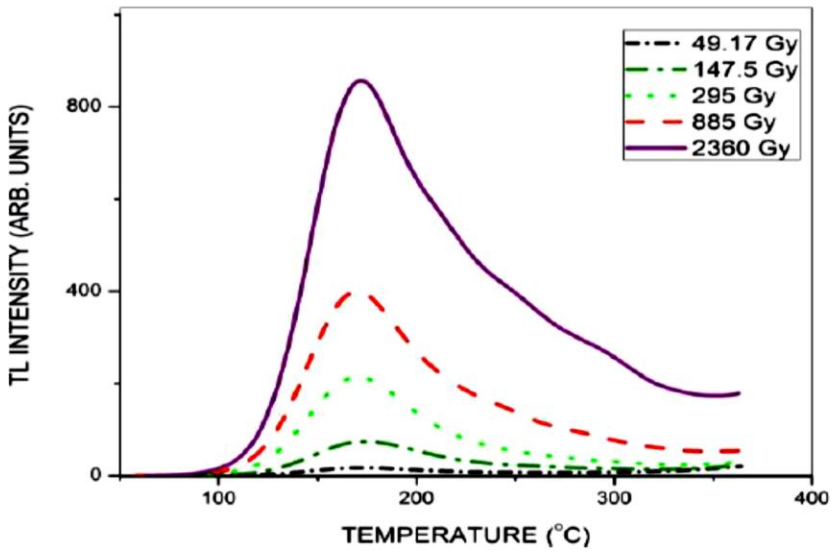

Fig. Thermoluminescence glow curve of La_2O_2S:Eu

- TL glow curve of $KCaBr_3$:Eu phosphor irradiated with gamma dose of 15 kGy. A dominant TL peak is observed at 240 0C with an unresolved peak at 174 0C. The heating rate used was 6 0C/s. The TL response of γ-irradiated La_2O_2S:Eu (4%) was recorded in the temperature range between room temperature to 300oC. The maximum TL-intensity corresponds to 172.84 oC, 173.4 oC, 170.6 oC, 170.2 oC and 171.3 oC for the dose value of 49.17 Gy, 147.5 Gy, 295 Gy, 885 Gy and 2360 Gy respectively. It was found that TL intensity strongly depends upon the γ-dose. It shows linear response upto 2.36 kGy. Hence Eu (4%) doped La_2O_2S could be used for TL Dosimetry up to 2.36 kGy.
- Result of the work carried out has been published in the form of research papers. One Research paper in International Journal and three in Proceeding of National Conference has been published. Two research papers are under preparation. The details are given bellow:
  1. C.D. Mungmode, D.H. Gahane, S.V. Moharil, ***"Optical Properties Of Eu^{2+} Activated Li_2MgBr_4 & Li_6MgBr_8 Phosphors"***, International Journal of Basic and Applied Research, Special Issue (2014), ISSN: 2249-3352, pp. 1-3.
  2. C.D. Mungmode, D.H. Gahane, S.V. Moharil, ***"Luminescence Characteristics of Eu^{2+} Activated $RbSr_2Br_5$ Phosphor"***, Proceeding of National Conference on "Advanced Materials", 1st March, 2014, pp. 161-163

3. C.D. Mungmode, D.H. Gahane, S.V. Moharil, ***"Eu^{2+} Emission in Rb_3ZnBr_5 and Rb_2ZnBr_4 Phosphors"***, Proceeding of National Conference.
4. C.D. Mungmode, D.H. Gahane, S.V. Moharil, ***"Synthesis & Photoluminescence of Blue Emitting $Ca_5(PO_4)_3Cl$ Phosphor***", Int. J. Luminescence and Applications, ISSN: 2277-6362, Vol. 5, No. 1, Feb. 2015, Article ID: 044. pp. 24-25.