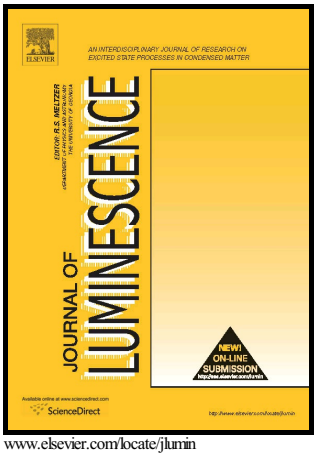

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Influence of alumina on photoluminescence and thermoluminescence characteristics of Gd^{3+} doped barium borophosphate glasses

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Abstract

Gd^{3+} doped barium borophosphate glasses mixed with varying concentration of Al_2O_3 are synthesized. Photoluminescence, thermoluminescence and other spectroscopic studies *viz.*, IR and EPR spectral studies, have been carried out. IR spectral studies of these glasses indicated that there is a gradual increase in the degree of depolymerisation of the glass network with increase in the concentration of Al_2O_3 upto 3.0 mol%. The EPR spectral studies revealed the lowest concentration of of Gd^{3+} ion clusters in the glass is mixed with 3.0 mol% of Al_2O_3. The photoluminescence emission spectra exhibited a strong ultraviolet blue emission at 311 under excitation at 273 nm due to $^6P_{7/2} \rightarrow {}^8S_{7/2}$ transition of Gd^{3+} ions. The intensity of this band is found to be enhanced four times when the glass mixed with 3.0 mol% of Al_2O_3 with respect to that of alumina free glass. The enrichment of this emission is attributed to the declustering of Gd^{3+} ions by Al^{3+} ions. Thermoluminescence (TL) characteristics of these glasses have also been investigated after irradiating them with different doses of γ-rays (in the range 0–8.0 kGy). The TL emission exhibited a dosimetric peak at about 200 °C. The TL output under this glow peak is observed to increase with increase of γ-ray dose. For any fixed γ-ray dose, the TL output is increased with increasing Al_2O_3 content up to 3.0 mol% and beyond this concentration quenching of TL is observed. The mechanisms responsible for TL emission and the variation in TL output with the concentration of Al_2O_3 are quantitatively discussed in terms of electron and hole centres developed due to interaction of γ-rays with the glass network. The dose response of these glass samples exhibited linear behavior in the dose range 0–8.0 kGy.

***Key words**:* UVB emission; Thermoluminescence; Gd^{3+} and Al^{3+} ions; Borophosphate glasses

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