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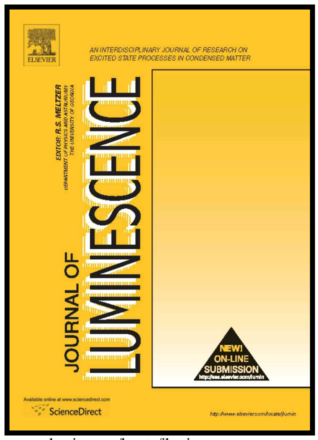


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# Multichannel emission from $Pr^{3+}$ doped heavy-metal oxide glass $B_2O_3$-PbO-$GeO_2$-$Bi_2O_3$ for broadband signal amplification

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**Abstract**

$Pr_2O_3$ doped 26.66$B_2O_3$-52.33PbO-16$GeO_2$-4$Bi_2O_3$-1$Pr_2O_3$ (BPGBPr) glass was synthesized by melt quenching technique. X-ray diffraction confirmed the amorphous nature of the glass and the presence of different vibrational groups was identified by Raman spectroscopy. Differential thermal analysis indicated that the glass transition and crystallization temperature were ~354°C and ~521°C respectively, indicating good thermal stability. Visible and near infrared absorption spectra were measured and used to evaluate the Judd-Ofelt intensity parameters to calculate the radiative properties for the emission levels of $Pr^{3+}$. Photoluminescence spectra were recorded in the visible and infrared regions at temperatures between 16 and 300 K. The spectroscopic results indicated that BPGBPr can be useful as a material for broadband optical amplifier in the region of ~1450 $cm^{-1}$.

keywords: heavy metal oxide glasses; praseodymium; Judd Ofelt theory; photoluminescence; NIR broadband



## 1. Introduction

Spectroscopic properties of rare earth (RE) ion doped glasses are attractive for the development of many optoelectronic devices such as lasers and amplifiers, optical sensors, high density memories and so on [1-6]. The optical properties of RE ions, specially the luminescence efficiency, are strongly influenced by the structural environment and phonon energies (PE) of the host glass [7]. For example, glasses with low PE can provide high fluorescence quantum efficiency, which is important for lasers and optical fiber amplifiers, but most of the hosts with low PE have, for instance, low thermal and mechanical stability [8]. Glasses containing heavy metals, on the other hand, have been studied for their promising applications in optoelectronic devices due to its low PE (~800 $cm^{-1}$) and large refractive index (~2.0) compared to silicates, borates and phosphates glasses [9–11]. In particular, $B_2O_3$-PbO-$GeO_2$-$Bi_2O_3$ (BPGB) system exhibits high chemical and good thermal stability, and it is transparent in the visible and infrared regions, being suitable for RE doping for different applications in optoelectronics [12–14].