

## Influence of Europium Ions on Structure and Crystallization Properties of Bismuth-Alumino-Borate Glasses and Glass Ceramics

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Glasses based on heavy metal oxides, such as  $\text{Bi}_2\text{O}_3$ , are interesting because their properties are exploited in applications such as wave-guides in non-linear optics, radiation shielding windows, scintillation counters, optical transmission devices, thermal and mechanical sensors, as well as optical devices, such as optical fibers, optical switching, optical memory etc. [1-4]. Glasses containing two glass-forming oxides, such as the bismuth borate glasses, which have superior properties, have a wide range of practical applications.  $\text{B}_2\text{O}_3$  is a typical glass former, while  $\text{Bi}_2\text{O}_3$  is a conditional glass former. The addition of an extra cation, such as  $\text{Al}_2\text{O}_3$ , to the bismuth borate glass network exerts an influence on the glass structure, because it directly influences the cross-linking between polyhedra constituting the three-dimensional network [5]. X-ray diffraction and FT-IR spectroscopy measurements have been employed to investigate the  $x\text{Gd}_2\text{O}_3 \cdot (100-x)[2\text{Bi}_2\text{O}_3 \cdot \text{B}_2\text{O}_3 \cdot \text{Al}_2\text{O}_3]$  glasses and glass ceramics system, with  $0 \leq x \leq 25$  mol%. Melting at 1100 °C for 15 minutes and rapid cooling at room temperature permitted to obtain glass samples. In order to improve the local order and to develop crystalline phases, the glass samples were kept at 550 °C for 24 h. FT-IR spectroscopy data suggest that the europium ions play the network modifier role in the studied glasses. These data show that the glass structure consists of the  $\text{BiO}_3$ ,  $\text{BiO}_6$ ,  $\text{BO}_3$ ,  $\text{BO}_4$  and  $\text{AlO}_4$  structural units, and the conversion among these units mainly depends on the  $\text{Eu}_2\text{O}_3$  content. Density functional theory (DFT) calculations were employed to develop a model for ternary bismuth-alumino-borate glasses.

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