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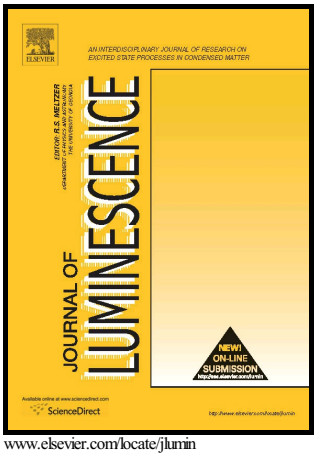

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Tb^{3+} as a probe for the molecular structure of mixed barium magnesium alumino silicate glasses

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Abstract

Two series of mixed barium magnesium alumino silicate glasses with the molar compositions (35-x) BaO · x MgO · 10 Al_2O_3 · 55 SiO_2 (mol%) (peralkaline series: x=0, 2.5, 5, 7.5, 10, 15, 25, 35) and (20-x) BaO · x MgO · 20 Al_2O_3 · 60 SiO_2 (mol%) (metaluminous series: x=0, 10, 20) have been prepared and doped with Tb^{3+} ions with a constant concentration of $1 \cdot 10^{20}$ cm^{-3}. Despite the constant doping concentration in all samples, the Tb^{3+} luminescence spectra and lifetimes show clear and systematic effects depending on the BaO/MgO and (BaO+MgO)/Al_2O_3 ratios in the samples. For the peralkaline glass series with 35 mol% network modifier oxides, the strong effect on the luminescence emission peak ratios and the Stark splitting of the emission peaks points to a strong influence of the network modifying ions and systematic changes in the Tb-Tb distances. For the metaluminous series with 20 mol% network modifier oxides and 20 mol% Al_2O_3, these changes are comparably small.

The Tb^{3+} luminescence lifetimes increase with increasing BaO concentrations in the peralkaline series but decrease in the metaluminous series. All effects are discussed with respect to the local surrounding of the doped Tb^{3+} ions.

keywords: terbium, Tb^{3+}, alumino silicate, glass, structure, symmetry