Ordering of Ba site in MgF2-rich barium fluoroborate glasses and their highly efficient photoluminescence

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Abstract

New oxyfluoride glasses of xMgF2– (66.7-2x/3)BaO–(33.3-x/3)B2O3 (x=10-50) (in mol%) were prepared by using a conventional melt-quenching method. The glass forming region is wider than oxide (MgO-BaO-B2O3) system. Glass structure was investigated by 11B- and 19F- MAS NMR, Raman scattering spectroscopy, X-ray diffraction, and EXAFS.
It was indicated that the glass with x=40 is composed of BO3 units mainly, e.g., 92.8% of BO3 and 7.2% of BO4 units by 11B-NMR and fluorine between Mg and Ba ions by 19F-NMR. Three kinds of distances of Ba-Ba bonding were found in X-ray diffraction. The distances are consistent with the Ba-Ba distances of the out-of-plane direction and the in-plane direction in the oxyfluoride crystal of BaMgBO3F, composed of MgO4-BO3 oxide layers and Ba-F fluoride layers.
Glasses have wide UV transmittance region and it enhanced with addition of MgF2, i.e., _˜220 nm for 10MgF2 and _˜180 nm for 50MgF2 of UV cutoff. Photoluminescence properties of Eu3+-doped glasses were investigated. Quantum yield of glasses increased with addition of MgF2, i.e., red photoluminescence with 82 % for 10MgF2 and 98% for 50MgF2 of quantum yield in the visible region at the excitation of the wavelength 393 nm.

Keywords: Oxyfluoride glasses, Borates, Photoluminescence, X, ray diffraction, Rare earth

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