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LOCAL STRUCTURE OF A NEW FAMILY OF HIGH BaO CONTENT GLASSES BASED ON $BaO\text{-}SiO_2\text{-}Al_2O_3$ SYSTEM

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Resumen:

Two glasses labeled BAS-5, and BAS-7 based on the $BaO\text{-}SiO_2\text{-}Al_2O_3$ equilibrium diagram located within the compatibility triangle (BaSiO3-Ba2SiO4-BaAl2Si2O8) were fabricated. The main criteria used to select the glass composition was the precipitation after anealing (850ºC,2h) of Barium Silicate compounds and Hexacelsian due to its relatively high Coefficient of Thermal Expansion (CTE), 10–$12x10^{-6}$/ºC and up to $8x10^{-6}$/ºC respectively, and its excellent dielectric properties. These properties lead to the potential aplication of these obtained glass-ceramics in a large panoply of added value fields, such as sealings, coatings and optical applications. In these compositions, the amount of BaO (R++ glass modifier) ranges around 70 wt% and Al_2O_3 content around 5% wt. In order to reach adequate viscosity to cast the melt glass, part (5-10wt%) of the glass–forming SiO_2 was replaced by B2O3. The structure of the glasses was studied by Magic Angle Spinning Nuclear Magnetic Resonance (MAS-NMR) and Fourier Transform Infrared Spectroscopy (FTIR). It was indicated by Si-29 MAS-NMR spectra that silicon was present in different coodination with the Oxigen. Al-29 MAS-NMR spectra showed that four-fold coordinated aluminum Al (IV) was the dominant species with a second peak assigned to octahedral aluminum Al (VI). The FT IR and 11–B spectra suggested that the boron oxide has a large influence on the glass structure because the conversion of boron from triangular to tetrahedral coordination increases the connectivity of the structure. Furthermore, a distribution of silicate network including Si-O-Si stretching Q(4) and Q(3) and Si-O-NBO, Q(3) per SiO_4 was observed by the FTIR spectra.