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Influence of barium borosilicate glass on microstructure and dielectric properties of $(Ba,Ca)(Zr,Ti)O_3$ ceramics

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Abstract

Barium borosilicate (BBS) glass was added as a sintering aid to $(Ba_{0.7}Ca_{0.3})TiO_3$-$Ba(Ti_{0.8}Zr_{0.2})O_3$ (BCZT) ceramics at levels from 2 to 15 wt%, yielding enhanced densification. The addition of BBS also induced changes in phase composition, from predominantly tetragonal to orthorhombic at room temperature. It is shown that the changes in phase content are caused by a shift of the orthorhombic to tetragonal phase transformation from below room temperature to ≈ 50 °C. An additional high temperature transition around 120 °C was also identified. These observations are interpreted in terms of the development of chemical heterogeneity associated with the redistribution of dopant elements (particularly Zr and Ca) through the liquid phase during sintering. The relative permittivity and electric field-induced polarisation values were generally degraded by the presence of the glass phase, but a reduction in ferroelectric hysteresis and improved densification behaviour have potential benefits in dielectric energy storage applications.

Keywords: X-ray diffraction, barium titanate, borosilicate, glass, dielectric.