High decrease in $CaZrO_3$ sintering temperature using complex fluoride fluxes.

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Abstract

The effects of complex fluoride flux on the sintering and the electric/dielectric properties of $CaZrO_3$ ceramics are investigated. Four fluoride mixtures are tested: LiF-CaF_2-SrF_2, LiF-CaF_2-BaF_2, LiF-SrF_2-BaF_2 and LiF-BaF_2-B_2O_3. They are used because each of their associated phase diagrams show the existence of a eutectic composition having a low melting temperature. This liquid phase is used to promote the densification at low temperature. The effect of both quantity and change in the additions compositions are also investigated to optimise the resulting thermal and physical properties. In terms of sintering behaviour, the results are unambiguous, leading to a drastic decrease of the densification temperature with all the non-boric additions ($\leq$ 1000°C). The DC/AC measurements carried out on the materials sintered at low temperature (900 and 1000°C) and either in air or in reductive atmosphere follow the same trend when using non-boric additions, with high permittivities ($\geq$25), low dielectric losses ($<10.10^{-4}$), low temperature coefficients of the permittivity (<100ppm/K) and high insulating resistivities (up to 10^{15} Ω.cm); the high frequency measurements lead to similar conclusions revealing high QF products (up to 40 THz) using non-boric additions. The effect of the sintering temperature, the sintering atmosphere, the flux composition and its amount on these properties are also discussed.