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Enhanced Thermal Stability of Dielectric and Energy Storage Properties in 0.4BCZT-0.6BTSn Lead-Free Ceramics Elaborated by Sol-Gel Method

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Abstract : In the present paper, structural, dielectric, ferroelectric, and energy storage properties of pure perovskite lead-free BCZT, BTSn, and BTSn-BCZT ferroelectric ceramics have been investigated. Rietveld refinement of XRD data confirms the coexistence of the rhombohedral and orthorhombic phases at room temperature in the composite BCZT–BTSn ceramic. Remarkably, an improved recoverable energy density of 137.86 mJ/cm³ and a high energy storage efficiency of 86.19 % at 80°C under a moderate applied electric field of 30 kV/cm were achieved in the designed BCZT–BTSn ceramic. Besides, the sample exhibits excellent thermal stability of the energy storage efficiency (less than 3%) in the temperature range of 70 to 130 °C under 30 kV/cm. Such results make the pb-free BCZT–BTSn ferroelectric ceramic a very promising potential matrix for energy storage capacitor applications.

Keywords : sol-gel, ferroelectrics, lead-free, perovskites, energy storage
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