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Enhanced piezoelectric and ferroelectric properties of $BiFeO_3$-$BaTiO_3$ lead-free ceramics by optimizing the sintering temperature and dwell time

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Abstract

0.7$BiFeO_3$-0.3$BaTiO_3$ (BFO-0.3BT) ceramics were prepared to uncover the impacts of sintering temperature (T_S) and dwell time (t_d) on the microstructure and electrical properties. With increasing the T_S or t_d, the grain sizes increase along with the porosity decreases, which is in favor of the alignment of dipole. However, excess T_S or t_d are inclined to cause the volatilization of Bi_2O_3, which deteriorates piezoelectric properties. Because of the *R*-*T* two-phase coexistence, low defect ions concentration and porosity, as well as appropriate grain size, the excellent d_{33}=208 pC/N and k_p=35.46% as well as P_r=28.52μC/cm^2 were achieved in BFO-0.3BT ceramics at T_S=1000 ºC and t_d=6h. In addition, large unipolar strain 0.13% and d_{33}*=256.2 pm/V also were obtained in BFO-0.3BT ceramics at T_S=1000 ºC and t_d=6h. This research indicates that the porosity and defect ion concentration as well as grain size also play an important role in piezoelectric properties in BFO-BT ceramics.

***Keywords*:** Bismuth ferrite, Piezoelectricity, Morphotropic phase boundary, lead-free piezoceramics.

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