Fabrication and Electric Properties of PZN-based Ceramics Using Modified Columbite Method

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Abstract

Pb(Zn1/3Nb2/3)O3 (PZN)-BaTiO3 (BT)-Pb(Zr0.52Ti0.48)O3 (PZT) ceramics prepared using solid state reactions via modified columbite methods by changing mixing sequences of the relevant oxides were investigated in the present work. Dielectric, ferroelectric and piezoelectric properties were evaluated and the corresponding microstructures were examined using transmission electron microscopy (TEM) and energy dispersive spectroscopy (EDS). Experimental results imply that preparation sequences of PZN -BT-PZT ceramics are extremely important to fabricate a good sample even using a conventional columbite (CC) method, i.e., it is difficult to obtain acceptable specimens for PZN prepared using a conventional columbite method and then mixed, calcined and sintered with PT, PZ and BT. A modified approach (MC) of mixing and calcining all B-site elements first, and then mixed and sintered with all A site elements was adopted. Electrical properties were enhanced but a small amount of pyrochlore phase still existed. Finally, a sequential mixing and calcining (sequential mixing columbite, SMC) of well calcined B-site elements, first with BaO, and then with PbO was utilized to fabricate specimens. A full perovskite structure of the specimen with excellent electrical properties can be obtained. Microstructural investigations showed Ba segregation at triple junctions for CC and MC processes, implying that diffusivity and complete mixing of A-site species could not be completely achieved due to a pre-formation of the perovskite phases, which influences electrical properties significantly.