

(10-029) - Improvement of functional properties of KNN-based lead-free piezoceramics by control of the sintering atmosphere and the poling process

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Dense lead-free KNN-modified piezoelectric ceramics were prepared by the conventional mixed oxide method. The effect of different sintering conditions on some structural, dielectric and piezoelectric properties was studied. Furthermore, the influence of the room temperature orthorhombic to tetragonal phase transition on the poling process was also examined. The improvement of the piezoelectric properties when the poling temperature is around room temperature was evidenced by X-ray diffraction analysis and Raman spectroscopy. Results have been shown that the polarization process was assisted by the stabilization of orthorhombic phase, which promotes a stress reduction in the material. Moreover, dielectric and piezoelectric studies have revealed that the maximum values of the room temperature dielectric constant and piezoelectric coefficient are reached when material is sintered under oxygen, which appears to be related to the low probability of complex defect formation. However, a high nonlinear response (dielectric instabilities) is observed in this case due to free motion of the domain walls. The relative increase in the dielectric constant indicates that sintering in an inert atmosphere appears to be an additional way of reducing nonlinearity in KNN ceramics in order to obtain more stable lead-free piezoceramics.
