

The Potential Application of $\text{Na}_{1/2}\text{Bi}_{1/2}\text{TiO}_3$ -based Ceramics in Large-displacement Actuation

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$\text{Na}_{1/2}\text{Bi}_{1/2}\text{TiO}_3$ -based ceramics are thought as a group of promising lead-free piezoelectric materials and they are studied more and more intensely at present. Large displacement actuation is one of the important applications of piezoelectric materials. Because the piezoelectric constant of BNT-based ceramics measured by Berlincourt method is no more than 150 pC/N, it seems that the materials are not suitable for large displacement actuation. However, in our work it was found that BNT-BT ceramic wafers could produce very large displacement under DC electric field although the piezoelectric constant measured by Berlincourt method was very small. It makes them possible to be used as large displacement actuator. There are two possible mechanisms for this phenomenon. The first one may be due to the semiconductivity of BNT-BT ceramics. In this case the BNT-BT ceramic wafers are similar to monomorph device. The other reason may be ascribed to the anomalously intense space charge effect in them.

Low Temperature Sintering and Piezoelectric Properties of ZnO Added $0.41\text{Pb}(\text{Ni}_{1/3}\text{Nb}_{2/3})\text{O}_3$ - 0.36PbTiO_3 - 0.23PbZrO_3 Ceramics

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$0.41\text{Pb}(\text{Ni}_{1/3}\text{Nb}_{2/3})\text{O}_3$ - 0.36PbTiO_3 - 0.23PbZrO_3 (0.41PNN-0.36PT-0.23PZ) ceramics have the pseudo-cubic structure and changed to the tetragonal structure when ZnO was added. For the specimens sintered above 1000°C, bulk density slightly decreased with the addition of ZnO but it significantly increased for the specimens sintered below 1000°C. Curie temperature (T_c) and the maximum dielectric constant increased when ZnO was added. The coercive electric field (E_c) and mechanical quality factor (Q_m) increased with the addition of the ZnO but piezoelectric constant (d_{33}), electromechanical coupling factor (k_p) and dielectric constant (ϵ^T_3/ϵ_0) decreased with the addition of ZnO for the specimens sintered above 1000°C. However, for the specimens sintered below 1000°C, the addition of ZnO significantly improved the piezoelectric and dielectric constants, which could be due to the improvement of the bulk density. The good dielectric and piezoelectric properties of $d_{33}=525(\text{pC/N})$, $k_p=0.53$ and $\epsilon^T_3/\epsilon_0=3400$ were obtained for the specimen with 3 mol% of ZnO sintered at 950°C for 1 h.