B-9

The Potential Application of $Na_{1/2}Bi_{1/2}TiO_3$-based Ceramics in Large-displacement Actuation

Chu Baojin, Jeong Ho Cho, Yong Hyun Lee, Byung Ik Kim
Advanced Materials and Components Lab., Korea Institute of Ceramic Eng. & Tec.

$Na_{1/2}Bi_{1/2}TiO_3$-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 beused 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

B-10

Low Temperature Sintering and Piezoelectric Properties of ZnO Added $0.41Pb(Ni_{1/3}Nb_{2/3})O_3$-$0.36PbTiO_3$-$0.23PbZrO_3$ Ceramics

Cheol-Woo Ahn, Si-Yoon Noh, Sahn Nahm*, Jungho Ryu**,
Kenji Uchino**, Seok-Jin Yoon***, Jae-Sung Song****
*Department of Materials Science and Engineering, Korea University
**International Center for Actuators and Transducers, Materials Research Institute, The Pennsylvania State University, University Park, PA 16802, U.S.A.
***Thin Film Technology Research Center, Korea Institute of Science and Technology
****Electric and magnetic Devices Group, Korea Electrotechnology Research Institute

0 41$Pb(Ni_{1/3}Nb_{2/3})O_3$-0 36$PbTiO_3$-0 23$PbZrO_3$ (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 ($\varepsilon^T_3/\varepsilon_o$) 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(pC/N), k_p=0 53 and $\varepsilon^T_3/\varepsilon_o$=3400 were obtained for the specimen with 3 mol% of ZnO sintered at 950°C for 1 h