反強誘電体 $NaNbO_3$–$CaZrO_3$ セラミックスへの MnO 添加効果

Effects of MnO Addition to Anti-Ferroelectric $NaNbO_3$ – $CaZrO_3$ Ceramics

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Recently, anti-ferroelectoic materials has been attracting attentions due to possible applications to new memory devices, energy storage devices, mechanical switches, and electric calorie materials. Anti-ferroelectric materials are anti-polar crystals consisting of two equally and opposing ferroelectric sublattice. Anti-ferroelectric materials exhibit double hysteresis loops. Each hysteresis loop represents the induced ferroelectric phase with polarization in the direction of one of the two sublattices. Antiferroelectric materials have been attracting attention in high energy storage capacitor. By using proper AFE to ferroelectric (FE) transition, higher energy storage can be achieved. It is relatively difficult to prepare a sample that draws a double hysteresis loop of polarization. In the case of $NbNbO_3$ containing no additive, when a high electric field is applied at room temperature, a hysteresis loop like a ferroelectric substance is often drawn. $CaZrO_3$ is known as an effective additive compound for exhibiting antiferroelectric properties of $NaNbO_3$ ceramics. In this work, antiferroelectric $NaNbO_3$ ceramics were fabricated by solid state reaction. Additive compounds of MnO were evaluated.

0.96$NaNbO_3$ – 0.04$CaZrO_3$ ceramics were prepared by solid state reaction. The crystal structure, microstructure, and the dielectric and electromechanical properties are investigated. Lead free $NaNbO_3$-$CaZrO_3$ ceramics were fabricated. The addition of MnO improves the sinterability and dielectric properties. Superlattice peaks were observed from the 0.96$NaNbO_3$-0.04$CaZrO_3$ sintered at 1100-1350°C. Constrictions in P-E loops and rapid increases in S-E loops accompanying switching were observed in the 0.96NN and 0.04 $CaZrO_3$ plus 3mol% MnO sintered at 1250 °C.

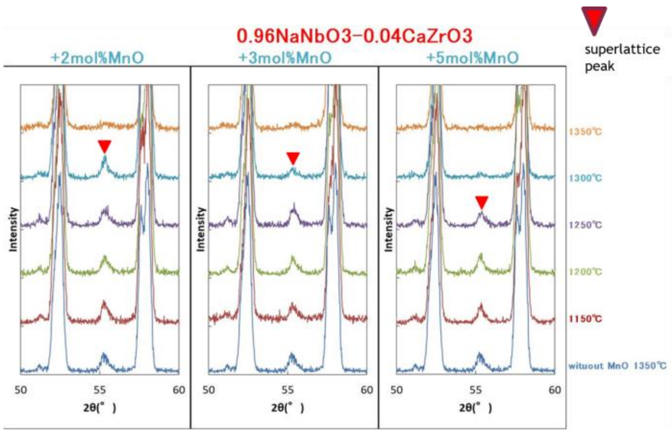

Fig. 1. XRD patterns of 0.96$NaNbO_3$-0.04$CaZrO_3$ ceramics sintered at 1100-1350°C.

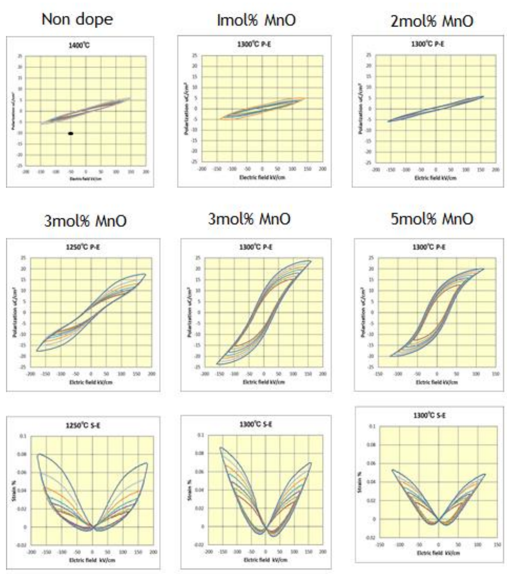

Fig. 2. P-E and s-E loops of 0.96$NaNbO_3$-0.04$CaZrO_3$ ceramics sintered at 1100-1350°C.

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