

誘電体 $\text{Bi}_{4-x}\text{Ln}_x\text{Ti}_3\text{O}_{12}$ セラミックスの電気特性と電気機械特性

Electrical and Electromechanical Properties of $\text{Bi}_{4-x}\text{Ln}_x\text{Ti}_3\text{O}_{12}$ Ceramics

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Bismuth titanate-based ceramics are considered to be candidates for use as lead-free piezoelectrics. Recent studies revealed that Bi^{3+} ions in $\text{Bi}_4\text{Ti}_3\text{O}_{12}$ structure can be substituted by trivalent rare earth ions, such as La^{3+} , Nd^{3+} , and Sm^{3+} , for the improvement of its properties in thin film forms.¹ In this work, ferroelectric $\text{Bi}_{4-x}\text{Ln}_x\text{Ti}_3\text{O}_{12}$ ceramics were fabricated by solid state reaction. Ln element of La and Nd were evaluated. $\text{Bi}_4\text{Ti}_3\text{O}_{12}$ (BIT) ceramics and $\text{Bi}_{3.25}\text{Ln}_{0.75}\text{Ti}_3\text{O}_{12}$ ceramics (Ln = La or Nd, BLT and BNT) ceramics were prepared by solid state reaction. The crystal structure, microstructure, and the dielectric and electromechanical properties are investigated. Substitution of Bi with La or Nd deteriorates sinterability, and the optimum sintering temperatures are higher than that of BIT. The firing temperatures of BIT, BLT, and BNT shown below are 1000 °C, 1100 °C and 1150 °C, respectively. In each case, the crystal grains grew as the sintering temperature increased. Most samples showed c-axis orientation in which flat particles spread. Figures 1 and 2 show polarization – electric field (P-E) loops and strain – electric field (s-E) loops of BIT, BLT and BNT, respectively. BNT has a large remanent polarization value, but also has a large coercive field (E_c). BLT shows the largest strain value among them. Since BNT has a large E_c , the maximum strain was not so large under the applied electric field. The results of piezoelectric properties will also be reported.

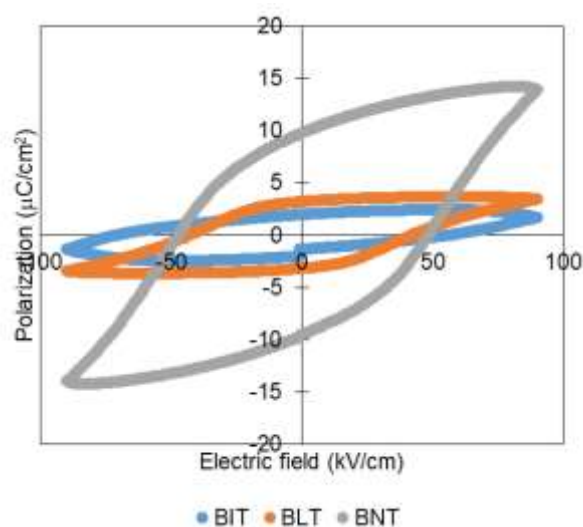


Fig. 1. P-E loops of BIT, BLT and BNT.

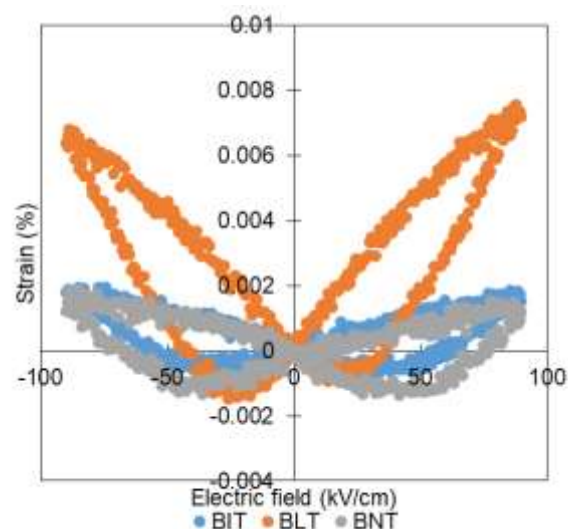


Fig. 2. s-E loops of BIT, BLT and BNT.

1. H. Maiwa *et al.*, Appl. Phys. Lett. **82**, 1760 (2003); doi: 10.1063/1.1560864