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# Electrical properties of 100-oriented $(1-x)BiFeO_3$-$x(Bi_{0.5},K_{0.5})TiO_3$ thin films on $LaNiO_3$ electrode

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## [Introduction]

$BiFeO_3$-$(Bi_{0.5},K_{0.5})TiO_3$ (BF-BKT) system is one of the candidate of lead-free piezoelectric ceramics because it is reported that BF-BKT ceramics have large piezoelectric constant ($d_{33}$=370pm/V).[1)] This result is encouraging for the improvement of piezoelectric constant of Bi-base perovskite ferroelectric thin films.[2)] In this study, we investigate the phase development for crystallization process and electrical properties of BF-BKT thin films grown on (100) oriented $LaNiO_3$/Si.

## [Experimental Procedure and results]

0.6BF-0.4BKT films were deposited by rf-sputtering method. 0.6BF-0.4BKT ceramic disk with 10% excess Bi prepared by conventional ceramic process was used as a target. The films were grown on (100) $LaNiO_3$ (LNO)/Si substrates under the process pressure of 1 Pa with an $Ar:O_2$ ratio of 4:1. The thickness of the films was fixed as ~240 nm. Figure 1 show the XRD profiles of 0.6BF-0.4BKT thin films deposited at the substrate temperature between 475 °C and 575 °C. While all the films crystallized in perovskite phase, the integrated diffraction intensities of 200 peaks of the films are highest at 505 °C and the lattice constant decreases with increasing growth temperature. It was also found that the films deposited at higher temperature have the deficiencies of $Bi^{3+}$ and $K^+$. The polarization-voltage (*P-V*) hysteresis loop of the films was measured at room-temperature. Although the films deposited above 540 °C do not show the hysteresis behavior, the ferroelectricity is observed for the films deposited at below 505 °C as shown in Fig. 2. It appears this is also caused by the evaporation of $Bi^{3+}$ and $K^+$ at higher deposition temperature. In the presentation, the piezoelectric properties of the films are also discussed.

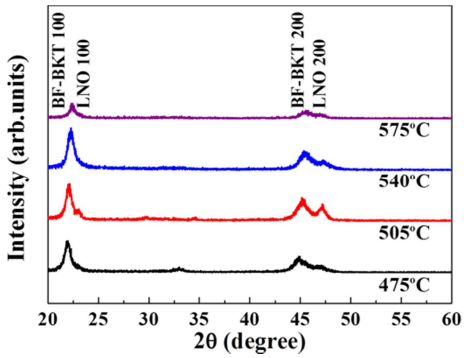


Fig. 1. XRD patterns of a 0.6BF-0.4BKT thin film fabricated on (100) LNO/Si

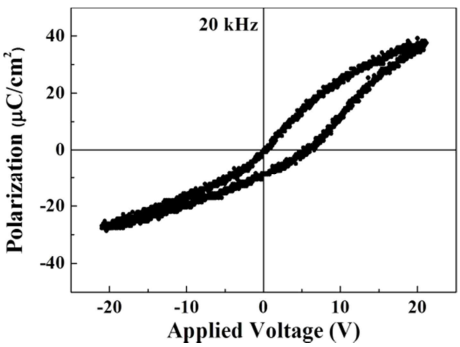


Fig. 2. Ferroelectric *P-V* hysteresis loop of the BF-BKT thin film deposited at 505 °C

## [Reference]

1) M. I. Morozov et al., Appl. Phys. Lett. **101**, 252904 (2012).

2) C. –J. Cheng et al., Appl. Phys. Lett. **97**, 212905 (2010).