反強誘電体 $PbZrO_3$ 薄膜の分極反転挙動とメモリ効果

Polarization Reversal and Memory Effects in Anti-Ferroelectric $PbZrO_3$ Thin Films

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Recently, anti-ferroelectoic materials has been attracting attentions due to possible applications to new memory devices. 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. Since the anti-ferroelectric materials two quasi-remanent polarization states depending the history of the applied electric field for one sublattice. there are four remanent memory states for two sublattices. [1].

In this study, the polarization reversal and memory effects in anti-ferroelectric $PbZrO_3$(PZ) films are evaluated. Preparation and basic properties of PZ films were reported. [2] PZ films were fabricated from two sol-gel-type solutions. The starting Pb/Zr ratio of the solutions was 1.1:1. The solutions were spin-coated onto a $Pt/Ti/SiO_2/Si$ substrate. The films were then dried in air at 400ºC for 10 min. This process was repeated three times, and the films were crystallized in air at various temperatures (600 - 700ºC) for 1 h. The obtained film was (111) oriented, the thickness was 500 nm. Thin-film Pt top electrodes were deposited by magnetron sputtering. The polarization hysteresis loops and field-dependent dielectric constants were measured using ferroelectric tester (aixACCT TF2000) and Agilent Technology impedance analyzer, 4192A, respectively. The dielectric constants were computed from the capacitance measured at a small signal oscillation voltage of 100 mV and frequency of 100 kHz. Memory retention tests consisting “write” and “read” sequence were conducted by using ferroelectric tester. Prepared PZ films exhibited double hysteresis loop, as shown in Fig.1. And data retention tests show the possibilities of 4-state memory effects in the obtained PZ films.

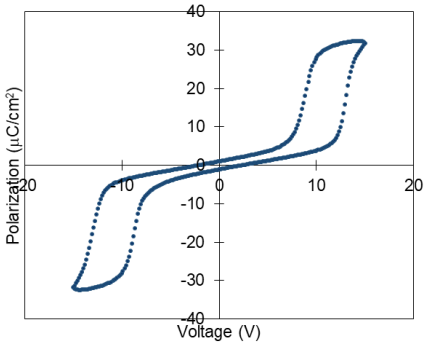

Fig. 1. Polarization-electric field (P-E) loop of the $PbZrO_3$ thin films.

References

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