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題目(和文)	電界および基板から印加された応力によって誘起されたエピタキシャルPb(Zr, Ti)O3膜の結晶構造変化に関する研究
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論文の要約

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概要

Ferroelectric and piezoelectric films have attracted attention due to their numerous potential applications, such as ferroelectric random access memories, sensors and microelectromechanical systems (MEMS). The electromechanical responses are dominated by the contribution of ferroelastic domains under an applied stress or electric field. However, in case of ferroelectric thin films, conventional belief is that the ferroelastic domains (i.e. non-180^{o} domains) are strongly pinned due to substrate-induced clamping.[1] Recently V. Anbusathaiah et al., reported that second order ferroelastic poly-domains in bilayered $Pb(Zr,Ti)O_3$ films are easily mobile under external bias.[2] However, a relevant question is whether such ferroelastic domains could be switched at ultra-fast time scales.

In this study, we appropriate *in-situ* synchrotron micro diffraction technique in conjunction with a nano-second order high-speed pulse generator setup to demonstrate that ferroelastic domains that can indeed move at time scales of the order of 100s of nanoseconds and detail method were already reported elsewhere.[3] In the Figure1, We saw a measurable change in lattice strain *222* peak and diffraction peak intensity originated from the *222* (180^{o} domain) and *22-2* (non-180^{o} domain) in epitaxial rhombohedral (11-1)/(111) Pb(Zr, Ti)O3 films with a corresponding change in these domain volume fraction even for pulses as short as 200 ns.

The apparent intrinsic piezoelectric coefficient ($d_{33,\mathrm{intrinsic}}$) values obtained from the peak positions shift under electric field were 20 and 0 pm/V for the (222), and (22-2) , respectively. However, the peak intensity of (22-2) dramatically decreased, while that of (222) increased under 200 ns short pulsed, indicating that the change of the volume fraction of each domain under electric field. Estimated $d_{33,\mathrm{extrinsic}}$ value obtained from changes of (22-2) to (222) peak intensity and positions considering elastic domain changes was 24 pm/V. Therefore, $d_{33,\mathrm{intrinsic+extrinsic}}$ which was good agreements with results of strain - electric field curves using conventional piezoresponse force microscopy, which suggests that ferroelastic domain switching under nano-second order contribute the effective d_{33} values.

References

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