

**Polarized Raman Scattering Study of Highly(111)-oriented PZT Films
in the Rhombohedral-Phase Field**

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Abstract

Highly (111)-oriented PZT [Pb(Zr_{1-x}Ti_x)O₃] thin films in the Zr-rich rhombohedral phase-field were successfully fabricated on Pt(111)/Ti/SiO₂/Si substrates by combining PLD method with sol-gel process. These highly (111)-oriented films can be used as model systems for polarized Raman scattering study of PZT in the rhombohedral-phase field because the [111]-direction is the principal off-center axis of the rhombohedral ferroelectricity. For this purpose, we have fabricated PZT films employing two distinctive compositions : one with Zr/Ti = 90/10 (abbreviated as PZT90/10) and the other with Zr/Ti= 60/40 (PZT60/40). The PZT90/10 film belongs to the octahedrally distorted FR(LT) phase with a cell-doubled structure, whereas the PZT60/40 is in the high-temperature FR(HT) phase-field at room temperature. To clearly separate E(TO) phonon modes from A₁(TO) modes of the (111)-oriented rhombohedral film, we have suitably devised Z(X,Y)Z and Z(X,X)Z backscattering geometries for E(TO) and A₁(TO), respectively. The polarized scattering experiment demonstrated that both types of (111)-oriented rhombohedral films closely followed the Raman selection rule.