

Coherently Strained Epitaxial Pb(Zr_{1-x}Ti_x)O₃ Thin Films

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Abstract: Coherently strained Pb(Zr_{1-x}Ti_x)O₃, 0.2 ≤ x ≤ 0.35, thin films were grown by pulsed laser deposition on (001) and (111) oriented SrTiO₃ substrates. A buffer layer of Pb(Zr_{0.6}Ti_{0.4})O₃ was used to improve the lattice matching and induce compressive strain in Zr-rich compositions. The (001)(pc) (pc = pseudocubic) films showed an increased ferroelectric transition temperature, T_C, compared to bulk ceramics, but the transition from an untilted to a tilted ferroelectric (T-Tilt) exhibited only a modest increase in temperature. This suggests that it may be possible to enlarge the untilted ferroelectric phase field by compressive strain. Consistent with previous work on relaxed PZT films, coherently strained PZT films do not exhibit an abrupt transition from an untilted to a tilted state; rather, a region of non-zero tilt exists above T-Tilt. (111)(pc) films also showed an increased ferroelectric transition temperature with a weak strain dependence on T-Tilt. The compressive strain in (111)(pc) films induced a preferred domain structure with only 180 degrees domain walls, in contrast to bulk materials and relaxed films which are polydomain. (C) 2013 AIP Publishing LLC.