Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Epitaxial complex oxide tunnel barriers JUNWOO SON, POUYA MOETAKEF, JOËL CAGNON, SUSANNE STEMMER, University of California, Santa Barbara — Tunnel junctions with complex oxide thin film barriers are of interest for studies of the critical thickness of ferroelectricity, of phonon modes in ultrathin films and of traps by inelastic tunneling spectroscopy. We show that high-quality epitaxial $SrTiO_3$ and $BaTiO_3$ tunnel barriers can be grown on Pt bottom electrodes. Coherent, epitaxial Pt films with roughness of less than a unit cell were grown on (001) $SrTiO_3$ to serve as bottom electrodes for epitaxial $SrTiO_3$ and $BaTiO_3$ tunnel barriers. All interfaces were atomically abrupt as confirmed by atomic resolution Z-contrast imaging. The IV characteristics were non-linear, demonstrating good insulating properties. For the $SrTiO_3$ barriers and voltage sweeps up to $\pm$ 0.5 V, the measured tunnel current was independent of the sweep direction. At low biases, dynamic conductance curves showed a symmetrical parabolic shape around the origin in both resistance states. At high bias, deviation from the ideal tunnel behavior was observed. A large increase of the tunnel conductance occurred above a minimum positive bias. A dramatic decrease of tunnel conductance occurred for a large negative bias, indicating bipolar switching. We show the contributions to the resistive switching. Phonon modes and traps are determined using inelastic tunneling spectroscopy with both paraelectric and ferroelectric tunnel barriers.

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Date submitted: 07 Dec 2008 Electronic form version 1.4