Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Epitaxial oxide heterostructures on silicon AGHAM POSADAS, J.W. REINER, F.J. WALKER, C.H. AHN, Yale University — Silicon-based MOSFETs will soon be limited by the large off- state leakage current due to tunneling through the 1 nm thick silicon oxynitride gate dielectric layer. One solution is to replace the silicon oxynitride with a high dielectric constant material, such as $LaAlO_3$, which has a relatively large dielectric constant of $\tilde{2}4$ and band gap of 5.6 eV. We have recently grown $LaAlO_3$ epitaxially onto silicon via a transition layer consisting of $SrTiO_3$. The thickness of this $SrTiO_3$ layer is kept between 2 and 5 unit cells because of considerations of epitaxial strain and the atomic-scale interactions between the perovskite structure and the silicon substrate. The oxide heterostructures show atomically abrupt interfaces and dielectric constants close to the bulk value of $LaAlO_3$. Frequency and voltage dependent measurements of the complex impedance of the as-grown oxide heterostructures show a pinned Fermi level and a high density of interface states. Annealing at low temperatures in wet oxygen shows that the Fermi level can be unpinned, with a greatly reduced density of interface states.

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Date submitted: 26 Nov 2007 Electronic form version 1.4