Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

**Spectroscopic Study of Band Alignment in Alternative High-k MOS Dielectric Stacks** E. BERSCH, S. RANGAN, E. GARFUNKEL, R.A. BARTYNSKI, Rutgers University — The study of high-k dielectrics and metal gate electrodes is critical to next generation MOSFETs. We have measured the band offsets of alternative MOS stacks using photoemission and inverse photoemission in the same chamber as well as synchrotron photoemission. At Rutgers, we have measured the valence and conduction band densities of states (DOS) and edges with UV photoemission and inverse photoemission, respectively, in situ. Using synchrotron photoemission we have measured the core level positions as well as the valence band DOS of clean and metallized dielectric/Si systems. The measurement of the chemical shifts of the core levels upon metallization enables us to evaluate the conduction band offset at the metal/dielectric interface. For Hf(x)Si(1-x)O(2), we find the conduction band offset (CBO) does not change as x is varied from 1 to 0.8, but the valence band offset increases by 0.4 eV. Titanium, aluminum and ruthenium were chosen as gate metals because of their prospective use as low and high workfunction metals in dual metal gate CMOS devices. We measured the CBO for the Ti, Al and Ru/Hf(x)Si(1-x)O(2) interfaces and found barriers involving Ti and Ru to be in good agreement with the interface gap state model, whereas the barrier involving Al deviated substantially from it due to the formation of an AlO(X) layer at the interface.

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Date submitted: 02 Dec 2006 Electronic form version 1.4