Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Resistive and Capacitive Memory Effects in Oxide Insulator/ Oxide Conductor Hetero-Structures RENE MEYER, Rambus, Sunnyvale, California, MAOSHENG MIAO, University of California, Santa Barbara, California, JIAN WU, CHRISTOPHE CHEVALLIER, Rambus, Sunnyvale, California — We report resistive and capacitive memory effects observed in oxide insulator/ oxide conductor hetero-structures. Electronic transport properties of Pt/ZrO_2/PCMO/Pt structures with ZrO_2 thicknesses ranging from 20A to 40A are studied before and after applying short voltage pulses of positive and negative polarity for set and reset operation. As processed devices display a non-linear IV characteristic which we attribute to trap assisted tunneling through the ZrO_2 tunnel oxide. Current scaling with electrode area and tunnel oxide thickness confirms uniform conduction. The set/reset operation cause an up/down shift of the IV characteristic indicating that the conduction mechanism of both states is still dominated by tunneling. A change in the resistance is associated with a capacitance change of the device. An exponential relation between program voltages and set times is found. A model based on electric field mediated non-linear transport of oxygen ions across the ZrO_2/PCMO interface is proposed. The change in the tunnel current is explained by ionic charge transfer between tunnel oxide and conductive metal oxide changing both tunnel barrier height and PCMO conductivity. DFT techniques are employed to explain the conductivity change in the PCMO interfacial layer observed through capacitance measurements.

Rene Meyer
Rambus, Sunnyvale, California

Date submitted: 06 Dec 2012 Electronic form version 1.4