Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Inelastic Electron Tunneling Spectroscopy Study of MOS Diodes Based on High-κ Gate Dielectrics S.L. YOU, C.C. HUANG, C.J. WANG, H.C. HO, J. KWO, Department of Physics, National Tsing Hua University, Hsinchu, Taiwan, W.C. LEE, K.Y. LEE, Y.D. WU, Y.J. LEE, M. HONG, Department of Materials Science and Engineering, National Tsing Hua University, Hsinchu, Taiwan — Inelastic electron tunneling spectroscopy was applied to characterize the microstructure, interface, and trap-related states in silicon MOS diodes made of high κ gate dielectrics HfO_2, Y_2O_3, and stacked HfO_2/Y_2O_3 bilayers by molecular beam epitaxy and atomic layer deposition under various heat treatments. Reproducible vibrational modes of monoclinic $HfO_2$and cubic Y_2O_3 were identified from IETS spectra. The gate bias dependence of the spectrum enables to ascribe the phonon modes adjacent to the lower or upper interface. A simple modeling was employed to analyze the trap related features in the spectra of stacked HfO_2/Y_2O_3 bilayers, and showed that most traps are located near the HfO_2/Y_2O_3 interface due to dissimilar charge distributions of two ionic oxides of different cation valences, and the interfacial strains of dissimilar structures. Work is now extended to Y-doped HfO_2 films in cubic phase with an enhanced κ over 30.

Yao-Chung Chang

Date submitted: 27 Nov 2007

Electronic form version 1.4