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**Oxide charge and band alignments in Pt/epi-$Lu_2O_3$/Si (111) structures studied by Internal Photoemission and C-V measurements**
W. CAI, J.P. PELZ, Ohio State Univ., C. ADAMO, D.G. SCHLOM, Pennsylvania State Univ. — A variety of rare-earth/transition metal oxide films (of interest as possible "high-k" gate dielectrics for future MOS devices) were found to have similar band gap and band alignments to Si, and "tailing" conduction band (CB) states extending ∼1 eV below the "primary" CB [1]. We used internal photoemission/photoconductivity (Int-PE/PC) and capacitance-voltage (C-V) measurements to study 20 nm-thick epitaxial $Lu_2O_3$ film grown at 700 °C on Si(111). A ∼1.5V difference between the oxide- and Si- flat band voltages (measured by PC and C-V respectively) indicates $\sim 6 \times 10^{12}$ cm$^{-2}$ fixed positive oxide charge, which was mostly removed by a ∼350 °C post-metallization vacuum anneal. Int-PE measurements indicate the CB measured from the metal-side lines up ∼0.4 eV below the "primary" CB measured from the Si side, in contrast with our finding on Pt/epi-$Sc_2O_3$/Si (111) [2] that the metal-side CB aligned with the tail-state CB. Also, Ballistic Electron Emission Microscopy of Pt/epi-$Lu_2O_3$/Si (111) found ∼0.3 - 0.4 eV higher energy barrier than found by Int-PE, suggesting significant transient charge trapping in this sample. Work supported by NSF Grant No. DMR-0505165. [1] V. V. Afanas'ev *et al.*, Appl. Phys. Lett. **85**, 5917 (2004); **88**, 032104 (2006). [2] W. Cai *et al.*, Appl. Phys. Lett. **91**, 042901 (2007).

Camelia Marginean
Ohio State Univ.

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