

Abstract Submitted
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Detection of Dielectric Trap States in Hafnium Oxide By Single Electron Tunneling Force Spectroscopy¹ DUSTIN WINSLOW, JON JOHNSON, CLAYTON WILLIAMS, Department of Physics, University of Utah — Atomic scale detection and imaging of electronic trap states in dielectric films has recently been demonstrated.² Standard methods typically provide characterization over a much larger scale. Single Electron Tunneling Force Spectroscopy has been employed to measure the energy levels of trap states in HfO₂ with sub-nanometer spatial resolution. Analysis of individual spectra obtained at different locations shows variation in the density of defect states. When multiple spectra taken from 40 different locations are averaged, a broad peak 0.3 eV below the conduction band is observed, which agrees with data obtained over large areas by standard measurements.³ Additional peaks, not seen by the standard methods, are also observed. The method will be described and the data discussed.

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²J.P. Johnson et al, Nanotechnology **20** (2009) 055701

³G. Ribes et al, IEEE Trans. Dev. Mat. Reliability **6**, 132 (2006).

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