Abstract Submitted
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3D mapping and energy measurement of trap states in inter-layer dielectric films by Dynamic Tunneling Force Microscopy[1] RUIYAO WANG, Department of Physics and Astronomy, University of Utah, Salt Lake City, UT, SEAN KING, Logic Technology Development, Intel Corporation, Hillsboro, OR, CLAYTON WILLIAMS, Department of Physics and Astronomy, University of Utah, Salt Lake City, UT — A novel atomic scale scanning probe microscopy method–Dynamic Tunneling Force Microscopy / Spectroscopy (DTFM/S) [1] has been employed to image the 3D distribution and energy level of individual trap states in inter-layer dielectric (ILD) and other insulating films. DTFM images of several films of different compositions, each around 5 nm thick, show a similar trap state areal density of order of $5x10^{11}/cm^2$.The energy and depth of each state within tunneling range can be determined by performing the DTFM/S measurements as a function of applied voltage and probe tip height above the surface and a physical tunneling model. Nanometer scale conductance (c-AFM) and trap state imaging (DTFM) have been performed in the same location on one of the films, revealing the correlation between the observed trap states and the conductance of the film. The imaging and energy level measurement results will be presented and discussed.
[1] J.P. Johnson, N. Zheng and C.C. Williams, Nanotech. 20, 055701 (2009)

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Ruiyao Wang
Department of Physics and Astronomy, University of Utah, Salt Lake City, UT

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