Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Measurement of Thicknesses of High-κ Gate-Dielectric Films on Silicon by Angle-Resolved XPS CEDRIC POWELL, NIST, Gaithersburg, WERNER SMEKAL, WOLFGANG WERNER, Technical University of Vienna — We report on the use of a new NIST database for the Simulation of Electron Spectra for Surface Analysis (SESSA) in measuring thicknesses of candidate high-κ gate-dielectric materials (HfO_2, $HfSiO_4$, ZrO_2, and $ZrSiO_4$) on silicon by angle-resolved XPS. For conventional measurements of film thicknesses, effective attenuation lengths (EALs) have been computed for these materials from SESSA as a function of film thickness and photoelectron emission angle (i.e., to simulate the effects of tilting the sample). These EALs are believed to be more accurate than similar EALs obtained from the transport approximation because realistic cross sections are used for both elastic and inelastic scattering in the film and substrate materials. We also present "calibration curves" showing calculated ratios of selected photoelectron intensities from thin films of HfO_2 on Si with an intermediate SiO_2 layer. These ratios provide a simple and convenient means of determining the thicknesses of SiO_2 and HfO_2 films for particular measurement conditions.

Cedric Powell
NIST

Date submitted: 16 Jan 2006

Electronic form version 1.4