Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Hole Injection from Silicon to Oxide Using Graphene as Transparent Electrode RUSEN YAN, NIST; University of Notre Dame, HUILI G. XING, University of Notre Dame, NHAN VAN NGUYEN, NIST — We demonstrate a novel application of graphene as a transparent electrode in internal photoemission (IPE) spectroscopy. Owing to its low absorption in the IR/Visible/UV range, graphene enables the direct observation of hole injection, and thus the measurement of both conduction and valence band offsets at the semiconductor-oxide hetero-interface. The photocurrents, consisting of electron or hole transitions between Si substrate and graphene as a function of incident photon energy under various applied gate voltage are measured. The barrier height is further determined from the photoemission quantum yield, which is defined as the ratio of photocurrent and light intensity. As a result, the barrier heights, φ_e^0, from the valence band top in Si to the bottom of the conduction band in Al_2O_3, and φ_h^0, from the bottom of the conduction band in Si to the top of the valence band in Al_2O_3 are extracted to be 3.5 eV and 4.1 eV, respectively. Furthermore, the bandgap of Al_2O_3 can be simply obtained by$E_g^{Al_2O_3} = \phi_e + \phi_h - E_g^{Si} = 3.5 + 4.1 - 1.1 = 6.5$eV, close to previously reported values. Similar phenomenon is also observed and confirmed by replacing Al_2O_3 with 10 nm SiO_2.

Nhan Van Nguyen
National Institute of Standards and Technology

Date submitted: 01 Nov 2012 Electronic form version 1.4