

# Effects of High- $\kappa$ Dielectrics on Workfunctions of Metal and Silicon Gates

Yee-Chia Yeo, Pushkar Ranade, Qiang Lu, Ronald Lin, Tsu-Jae King, and Chenming Hu

Dept. of Electrical Engineering and Computer Sciences, University of California, Berkeley, CA 94720, USA  
Phone: (510) 643-2638, Fax: (510) 642-2636, E-mail: [ycyeo@fermi.eecs.berkeley.edu](mailto:ycyeo@fermi.eecs.berkeley.edu)

We explore the dependence of metal and poly-silicon gate workfunctions on the gate dielectric. The interface-dipole theory is employed to explain our experimental observation that metal workfunctions on high- $\kappa$  dielectrics differ from their values in vacuum. Excellent agreement with experimental results is demonstrated. Weaker dependence of n+ and p+ poly-silicon gate workfunctions on gate dielectric is explained. Challenges and guidelines on the choice of gate materials for future CMOS technology incorporating high- $\kappa$  dielectrics are highlighted.