Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Internal Photoemission Spectroscopy of 2-D Materials NHAN NGUYEN, National Institute of Standards and Technology, MINGDA LI, SURESH VISHWANATH, RUSEN YAN, SHUDONG XIAO, HUILI XING, Cornell University, GUANGJUN CHENG, ANGELA HIGHT WALKER, QIN ZHANG, National Institute of Standards and Technology — Recent research has shown the great benefits of using 2-D materials in the tunnel field-effect transistor (TFET), which is considered a promising candidate for the beyond-CMOS technology. The on-state current of TFET can be enhanced by engineering the band alignment of different 2D-2D or 2D-3D heterostructures. Here we present the internal photoemission spectroscopy (IPE) approach to determine the band alignments of various 2-D materials, in particular $SnSe_2$ and WSe_2, which have been proposed for new TFET designs. The metal-oxide-2-D semiconductor test structures are fabricated and characterized by IPE, where the band offsets from the 2-D semiconductor to the oxide conduction band minimum are determined by the threshold of the cube root of IPE yields as a function of photon energy. In particular, we find that $SnSe_2$ has a larger electron affinity than most semiconductors and can be combined with other semiconductors to form near broken-gap heterojunctions with low barrier heights which can produce a higher on-state current. The details of data analysis of IPE and the results from Raman spectroscopy and spectroscopic ellipsometry measurements will also be presented and discussed.

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Date submitted: 22 Jan 2016 Electronic form version 1.4