Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Screening limited switching performance of multilayer 2D semiconductor FETs: the case for SnS[1] SUKRIT SUCHARITAKUL, Department of Physics, Case Western Reserve University, RAJESH KUMAR, Department of Chemistry, National Taiwan University,, RAMAN SANKAR, FANG-CHENG CHOU, Center for Condensed Matter Sciences, National Taiwan University, YIT-TSONG CHEN, Department of Chemistry, National Taiwan University,, CHUHAN WANG, CAI HE, RUI HE, Department of Physics, University of Northern Iowa, XUAN GAO, Department of Physics, Case Western Reserve University — Multilayer tin mono-sulfide (SnS) field-effect transistor (FET) devices with thickness between 50 to 100 nm with gate tunable p-type carriers were fabricated and studied. The fabricated devices demonstrated anisotropic inplane conductance and room temperature field effect mobility ranging from 5 to 10 cm^2/Vs. However, weak gate tuning was shown to underestimate the field effect mobility. The finite screening length effect was demonstrated to be the cause of appreciable OFF state conductance, ON-OFF ratio of 10 at room temperature and the weak gate tuning. Etching and n-type surface doping by Cs_2CO_3 to reduce non-gatable holes near the sample's top surface were perform and the devices showed an order of magnitude improvement in the ON-OFF ratio and hole Hall mobility ˜100 cm^2/Vs at room temperature is observed. This demonstrates that in order to obtain strong gate effect and switching on 2D semiconductor, the samples thickness must lie within the regime of Debye screening length. Work's online publication: DOI: 10.1039/C6NR07098A. **arXiv:1608.06501**

[1]Work at CWRU is supported by NSF Grant No. DMR-1151534, work at NTU is supported by the Ministry of Science and Technology of Taiwan grant No. MOST-103-2627-M-002-00 and work at UNI is supported by the NSF, Grant No. DMR-1552482 and DMR-1410496.

Sukrit Sucharitakul
Case Western Reserve University

Date submitted: 10 Nov 2016 Electronic form version 1.4