Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Large-scale 2D Electronics based on Single-layer MoS2[1] HAN WANG, LILI YU, YI-HSIEN LEE, WENJING FANG, ALLEN HSU, PATRICK HERRING, Massachusetts Institute of Technology, MATTHEW CHIN, Army Research Laboratory, MADAN DUBEY, US Army Research Laboratory, LAIN-JONG LI, Academia Sinica, Taiwan, JING KONG, TOMAS PALACIOS, Massachusetts Institute of Technology — 2D nanoelectronics based on MoS2 and other transition metal dichalcogenides (TMD) materials are attractive as high-mobility options in the emerging field of large-area low-cost electronics that is currently dominated by low-mobility amorphous silicon and organic semiconductors. Single-layer MoS2 can also complement graphene to build flexible digital and mixed-signal circuits, overcoming its lack of bandgap while still sharing many of graphene's excellent mechanical and thermal properties. This paper addresses several key challenges in the development of 2D nanoelectronics on MoS2 and TMD materials in general. First, large-area single-layer MoS2 material is grown by chemical vapor deposition (CVD) that makes the wafer-scale fabrication of MoS2 devices and circuits possible for the first time. Second, the top-gated transistors, fabricated for the first time on single-layer MoS2 grown by CVD, show multiple state-of-the-art characteristics, such as high mobility, ultra-high on/off current ratio, record current density and current saturation. Finally, key circuit building blocks for digital and analog electronics such as inverter, NAND gate, memory and ring oscillator are demonstrated for the first time.

[1]This work has been partially funded by the ONR Young Investigator Program and the Army Research Laboratory.

Han Wang
Massachusetts Institute of Technology

Date submitted: 09 Nov 2012 Electronic form version 1.4