Abstract Submitted for the MAR16 Meeting of The American Physical Society

Memristive Phenomena in Polycrystalline Single Layer MoS₂ VINOD SANGWAN, DEEP JARIWALA, IN-SOO KIM, KAN-SHENG CHEN, TOBIN MARKS, LINCOLN LAUHON, MARK HERSAM, Northwestern University, HERSAM LABORATORY TEAM¹ — Recently, a new class of layered twodimensional semiconductors has shown promise for various electronic applications. In particular, ultrathin transition metal dichalcogenides (e.g. MoS_2) present a host of attractive features such as high carrier mobility and tunable band-gap. However, available growth methods produce polycrystalline films with grain-boundaries and point defects that can be detrimental in conventional electronic devices. In contrast, we have developed unconventional device structures that exploit these defects for useful electronic functions.[1] In particular, we observe grain-boundary mediated memristive phenomena in single layer MoS₂ transistors. Memristor current-voltage characteristics depend strongly on the topology of grain-boundaries in MoS_2 . A grain boundary directly connecting metal electrodes produces thermally assisted switching with dynamic negative differential resistance, whereas a grain boundary bisecting the channel shows non-filamentary soft-switching. In addition, devices with intersecting grain boundaries in the channel show bipolar resistive switching with high on/off ratios up to 10^{3} .[1] Furthermore, the gate electrode in the fieldeffect geometry can be used to control the absolute resistance of the on and off states. Correlated electrostatic force microscopy, photoluminescence, and Raman microscopy reveal the role of sulfur vacancies in the switching mechanism. Refs: 1. Sangwan et al., Nature Nanotech, 10 403 (2015)

 $^1\mathrm{This}$ abstract is replacing MAR16-2015-004166 that had exceeded the character limit.

Vinod Sangwan Northwestern University

Date submitted: 01 Dec 2015

Electronic form version 1.4