Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Enhanced Chemical Vapor Sensing with MoS2 Using 1T/2H Phase Contacts/Channel ADAM FRIEDMAN, PAUL CAMPBELL, KEITH PERKINS, JAMES CULBERTSON, AUBREY HANBICKI, US Naval Research Laboratory — Transition metal dichalcogenides show remarkable potential for use in chemical vapor sensor devices. They are inexpensive, inherently flexible, low-power, can be grown in large areas, and have shown high sensitivity and selectivity to electron donor analyte molecules important for explosives and nerve gas detection. However, for most devices the conductance response is dominated by Schottky contacts, to the detriment of the sensitivity and obscuring the intrinsic sensing capability of the devices. We use contact engineering to transition the contacts in a MoS2 FET-based chemical vapor sensor to the 1T conducting phase, leaving the channel in the 2H semiconducting state, thus providing functional Ohmic contacts to the device. We show that the resultant sensors have greatly improved electrical characteristics, are more selective, and recover fully after chemical vapor exposureall major improvements to previous MoS2 sensor devices. We identify labile nitrogen-containing electron donors as the primary species that generate a response in MoS2, and we study the dynamics of the sensing reactions identifying two possible models for the chemical sensing reaction.

Adam Friedman
US Naval Research Laboratory

Date submitted: 01 Nov 2016 Electronic form version 1.4