Abstract Submitted
for the MAS17 Meeting of
The American Physical Society

Piezoelectricity of 2-Dimensional MoS_2/WS_2 Vertical Heterostructure[1] SHENG YU, TIKARAM NEUPANE, BAGHER TABIBI, FELIX JAETAE SEO, Hampton University — The two-dimensional atomic layers have a weak van der Waals coupling between layers, strong covalent in-plane bonds, large exciton binding energy, and reduced dielectric screening out-of-plane. The van der Waals heterostructure of p- and n-type atomic layers with different work functions has a type-II staggered gap alignment. The large band offsets of conduction band minima and valence band maxima between p- and n-type atomic layers results in significant electronic polarization and enormous piezoelectric energy conversion. Large elastic deformation and atomic polarization sensitivity to strain are excellent piezoelectric characteristics of heterostructure atomic layers. This presentation includes the piezoelectricity of MoS2 and WSe2 partial vertical heterostructure of AB and AA stacking as n- and p-type semiconductors with tensile strain along the transport direction. The output voltage of MoS2/WSe2 partial vertical AB stacking were 0.137 eV and 0.183 eV for the 4% and 8% tensile strain, respectively, to prove the piezoelectricity. The output voltage obviously depends on the stacking area, orientation, number of atomic layers, interlayer distance, and etc.

[1]This work is supported by ARO W911NF-15-1-0535, NSF HRD-1137747, and NASA NNX15AQ03A.

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Date submitted: 16 Sep 2017 Electronic form version 1.4