Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Functional polymers for electronic-structure modulation of MoS_2

ASHWIN RAMASUBRAMANIAM, Department of Mechanical and Industrial Engineering, University of Massachusetts Amherst, RYAN SELHORST, EGLE PUODZIUKYNAITE, JEFFREY DEWEY, Department of Polymer Science and Engineering, University of Massachusetts Amherst, PEIJIAN WANG, MICHAEL BARNES, Department of Chemistry, University of Massachusetts Amherst, TODD EMRICK, Department of Polymer Science and Engineering, University of Massachusetts Amherst — Two-dimensional semiconductors based on the Mo and W family of transition metal dichalcogenides (TMDCs) are emerging as an important class of materials with unique optoelectronic properties. However, there remain challenges associated with precise control over carrier doping and work functions that need to be overcome for device applications. We report the synthesis of new tetrathiafulvalene (TTF)-based polymers that provide enhanced solution stabilization of MoS_2 nanosheets while simultaneously modulating their electronic structure through robust, non-covalent interactions. Kelvin probe force microscopy (KPFM) imaging of TTF-polymer functionalized 2H MoS_2 nanosheets confirms n-doping of the MoS_2 with an accompanying reduction in the work function. Density functional theory calculations provide insight into the TTF-MoS_2 interfacial interactions and provide a theoretical basis for modulation of electronic properties of MoS_2 via charge-transfer interactions. These combined results illustrate the potential for polymer doping of TMDCs as a viable and scalable approach for synthesis of new hybrid materials for optoelectronics.

Ashwin Ramasubramaniam
Department of Mechanical and Industrial Engineering, University of Massachusetts Amherst

Date submitted: 05 Nov 2015 Electronic form version 1.4