UCF | NanoScience Technology Center

UNIVERSITY OF CENTRAL FLORIDA

GRADUATE RESEARCH SEMINAR SERIES

Friday
February 16, 2018

12:30 PM

Research Pavilion
NSTC
Room 169

Pizza and drinks will be provided

3-Dimensionally Ordered 2D MoS_2 Layer Patterns with Mechanically Tunable Functionalities

M. Ashraful Islam
Dr. Yeonwoong Jung's Group

Recent advances in materials processing and developments have provided alternative routes to the new geometrical layout of conventional materials for high -performance stretchable electronics and optoelectronics. However, it is still challenging to identify a suitable material system that can maintain desired electrical/ optical functionalities while tolerating large mechanical deformation required in such unconventional technologies. Two-dimensional (2D) transition metal dichalcogenides (TMDs) offer a rich set of extraordinary material properties implausible from any other materials owing to their unique anisotropic crystalline structure and near atom layer thickness. Particularly, their large in-plane strain limit (> 30%) coupled with high charge mobilities offer new venues for 2D stretchable technologies which can explore a wide range of applications impossible with conventional electronic materials and/or rigid devices based on them. In this seminar, I will talk about three-dimensionally (3D) ordered few-layer 2D MoS_2, one of the most scientifically/technologically important 2D TMDs, and their mechanically tunable multifunctionalities. I will present the systematic tuning of electrical, optical, and structural properties in 3D-patterned 2D MoS_2 under an application of tensile stretching and confirm their highly-tunable strain-driven controllability. Specifically, the 3D patterned-2D MoS_2 integrated on mechanically stretchable/flexible polymeric substrates are observed to maintain superior optical absorption and high electrical conductivity under extremely large strain (> 20 %) even beyond what is generally demanded in conventional stretchable electronics. The study suggests high promise of 2D TMDs for emerging stretchable electronics/ optoelectronics, evidencing their superior mechanical durability and electrical reliability.