UCF | NanoScience Technology Center

UNIVERSITY OF CENTRAL FLORIDA

GRADUATE RESEARCH SEMINAR SERIES

Friday
November 3, 2017

12:00 PM

Research Pavilion
NSTC
Conference Room 169

Pizza and drinks will be provided

Formation and Properties of Nanoscale Origami Features on 2D Material Properties

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Catalytic activation using metal-free systems is in high demand for industrial applications such as CO_2 capture and conversion. To achieve sustainable and recyclable processes, heterogeneous catalysis should be possible on these metal-free systems, which remains a challenge. Monolayer hexagonal boron nitride (h-BN) and potentially other two-dimensional (2D) materials may offer interesting characteristics for catalyzing alcohol synthesis reactions. Recently, defects such as vacancies and dopants have been shown to significantly modify the electronic and chemical properties of 2D materials, to offer catalytically active sites for the conversion of synthetic gases (H_2 and CO_2) into higher alcohols.

Here we introduce defects created by heat treatments, resembling origami features. The phenomenon was observed in graphene, Molybdenum Disulphide (MoS_2) and hexagonal boron nitride (h-BN). We will present a protocol for introducing and controlling origami features in the three materials. We will compare the characteristics of origami features formed on the three types of layers, including their structure, Raman signatures, mechanical properties and charge distribution. The measurements presented are carried out on an advanced Atomic Force Microscopy (AFM) platform including pulsed-force atomic force microscopy (PF-AFM), electrostatic force microscopy (EFM) and Lorentz contact resonance force spectroscopy (LCR) modules. Finally, we will discuss how these defects affect the catalytic activity of the materials for CO_2 capture and production of higher alcohols.