IBS Center for Multidimensional Carbon Materials

Special Guest Speaker

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Folded and Crumpled Two-dimensional Materials - Where Shape Enables New Functions

AUG 4 THUR
2 P.M.

Bldg. 101
Seminar room on the 1st floor

Superb electromechanical properties of two-dimensional (2D) materials provide substantial promise for advanced nanoelectromechanical devices, flexible electronics, and wearable sensor devices. Here I present unique fabrication and processing of folded and crumpled 2D materials-based micro-/nano-structures for advanced sensors. First, I introduce two approaches: (1) a rapid and scalable method of creating crumpled graphene and MoS_2 monolayer surfaces by soft-matter transformation of shape-memory polymers, and (2) swelling/shrinking-induced crumpling process. Second, I discuss our unique application of crumpled/buckled 2D materials for a stretchable photodetector with enhanced and strain-tunable photoresponsivity. Our photodetector is based exclusively on graphene and transforms the two dimensional material into three dimensional (3D) crumpled structures. This added dimensionality enhances the photoabsorption of graphene by increasing its areal density with a buckled 3D structure, which simultaneously improves device stretchability to 200% strain. A c.a. 400% enhancement in photoresponsivity is achieved compared to the responsivity of a flat graphene photodetector. Furthermore, we demonstrate a new concept of strain-tunable photoresponsivity where a 200% applied tensile strain results in 100% modulation in photoresponsivity. Our approach to forming crumpled 2D materials-based micro-/nano-structures offers a unique avenue for creating multifunctional sensors, and furthermore, these capabilities could be applied to stretchable and conformal interfaces for use in wearable electronics.

You are cordially invited to attend!