

11th International Conference on

ADVANCED MATERIALS & PROCESSING

September 07-08, 2017 | Edinburgh, Scotland

Epitaxial growth of 2D heterostructures toward pristine TMDs

Eui-Hyeok (EH) Yang

Stevens Institute of Technology, USA

This abstract summarizes some of our research activities concerning the growth and nanofabrication of 2D materials. TMDs are prone to rapid oxidation in air, presenting a critical roadblock in practical device applications. Here, we attempt to address the issue of oxidation of TMDs and find conditions for growing oxidation-free TMDs, which will mark a milestone for the coordinated improvement in their applications. To this end, we study chemical vapor deposition (CVD)-growth and extensive material characterization to provide deeper understanding of the role of other 2D substrates in the prevention of interior defects in TMDs and, thus, uncover the conditions for anti-oxidation. For the growth, we explore a direct/epitaxial growth process of 2D crystals. Our growth method permits the growth of transition metal dichalcogenides (TMDs) on the 'contacted' areas only, enabling fabrication of in-phase 2D heterostructures. This method facilitates localized, patterned, single crystalline or large-scale polycrystalline monolayers of MoS₂, WS₂, WSe₂ and MoSe₂. With this technique, we furthermore show the epitaxial growth of TMDs on hBN and graphene and vertical/lateral heterostructures of TMDs, uniquely forming in-phase 2D heterostructures. We examine the resulting quality and integrity of several heterostructure combinations using Raman, low temperature PL, XPS and SAED characterization, before and after oxidation. This research provides a detailed look into the oxidation and anti-oxidation behaviors of TMDs, which corroborates the role of underlying 2D layers in the prevention of interior defects in TMDs. If the technique could be developed to be highly reliable and high fidelity it could have a large impact on the future research and commercializability of TMD-based devices.

eyang@stevens.edu