J Material Sci Eng 2017, 6:2 (Suppl)
http://dx.doi.org/10.4172/2169-0022.C1.062

Pseudo-epitaxial growth of 2D heterostructures toward TMDs with an extremely low defect density

Eui-Hyeok 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 MoS_2, WS_2, WSe_2 and $MoSe_2$. 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

Temperatures and moisture contents effects on the resistance and self-sensing properties of carbon nanofiber cement-based mortar

Hui Wang, Xiaojian Gao and **Qinlin**
Harbin Institute of Technology, China

Effects of temperature and moisture content on electrical and piezoresistive properties of carbon nanofiber mortar (CNFM) were researched. Electrical resistivity of CNFM in different temperatures and moisture contents with w/c ratio 0.4 were experimentally determined. The CNFM used to study the environmental effects on resistance were reinforced with well dispersed carbon nanofibers in amounts from 0% to 2.5% by volume of cement. Piezoresistivity of CNFM with 1.5 vol.%, 2.0 vol.% and 2.5 vol.% of CNFs were determined at 20 ºC with the specimens dried at 60 ºC for three days before testing. Piezoresistive properties of CNFM including 2.5 vol.% of CNFs were investigated at different temperatures and moisture contents. Results indicated that the baseline of electrical resistivity shifted with the surrounding environments. The electrical resistance of CNFM incorporating different loadings of CNFs varied in different laws with temperatures under saturated and dry-out state. CNFM with 2.5 vol.% of CNFs (M25) shows the best sensitivity when tested at dry-out state at 20 ºC. Piezoresistivity of M25 had almost no variation with moisture contents when the temperature was lower than -5 ºC. M25 at 0% moisture content performed the best sensitivity of all moisture contents. The dry-out state at 20 ºC was the most favorable environment for the piezoresistive properties of CNFM.

gaoxj@hit.edu.cn