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CVD growth of in-plane heterostructures based on two-dimensional materials

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Abstract:

Conventional semiconductor heterojunctions with two-dimensional (2D) interfaces have been an important topic, both in modern solid state physics and in electronics and optoelectronics applications. Recently, the in-plane heterostructures based on two-dimensional materials are expected to provide a novel one-dimensional (1D) interface with unique physical properties and applications. Even though there have been many reports on the growth and device studies of such heterostructures, it is still an important challenge to develop a sophisticated growth process of novel heterostructures/superlattices and high quality samples without interface degradation, contamination and/or alloying. Here, we report on our recent progresses of chemical vapor deposition (CVD) growth of two-dimensional heterostructures based on transition metal dichalcogenide (TMDC) atomic layers [1-6]. We also show that the introduction of alkali metals improves various parameters, which includes grain size, uniformity of layer number, nucleation density, and defect density of TMDCs such as MoS2, WS2, MoSe2, and WSe2 monolayers. Furthermore, controlling the precursor supply and limiting air exposure enables the formation of in-plane heterostructures with atomically sharp and zigzag-edge straight junctions without defects or alloy formation around the interface. The present findings pave way for the simple and rapid preparation of large scale, high quality TMDCs, and TMDC-based heterostructures, quantum wires, and surperlattices.

[1] Y. Kobayashi *et al., ACS Nano*, 9, 4056 (2015).
[2] Y. Kobayashi *et al*., *Nano Res*., 8, 3261 (2015).
[3] S. Yoshida, *et al*., *Sci. Rep.*, 5, 14808 (2015).
[4] S. Sasaki *et al.*, *Appl. Phys. Express* 9, 071201 (2016).
[5] Y. Kobayashi *et al*., *Sci. Rep.*, 6, 31223 (2016).
[6] Y. Kobayashi *et al*., *Appl. Phys. Express* 10, 045201 (2017).

主催:　東京大学大学院工学系研究科専攻間横断型教育プログラム 機械システム・イノベーション（GMSI）
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