Growth of Complex 2D Materials-Based Structures with Naturally Formed Contacts

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Abstract

The difficulty of processing two-dimensional (2D) transition metal dichalcogenide (TMD) materials into working devices with any scalability is one of the largest impediments to capitalizing on their industrial promise [1,2]. Here, we describe a versatile, simple, and scalable technique to directly grow self-contacted thin-film materials over a range of TMDs (MoS2, MoSe2, WS2, and WSe2), where pre-deposited bulk metallic contacts serve as the nucleation site for the TMD material to grow, forming naturally contacted device structures in a single step [3]. The conditions for growth as well as optical and electrical properties are reported. Since the material grows controllably around the lithographically defined patterns, wafer scale circuits and complex device geometries can be produced including lateral heterostructures of different TMD materials.

References

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[3] Khadka, S.; Lindquist, M.; Aleithan, S. H.; Blumer, A. N.; Wickramasinghe, T. E.;Kordesch, M. E.; Stinaff, E. Adv. Mater.Interfaces 2017, 4 (4).

Figures

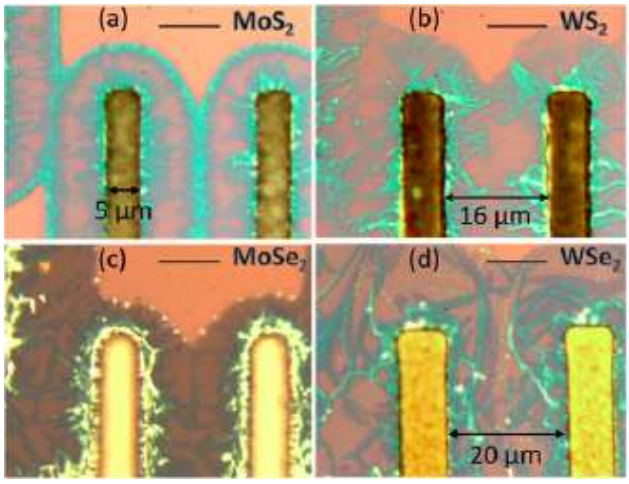

Figure 1: Optical images for the four TMD growths. (a) MoS_2 grown on Mo contacts. (b) WS_2 grown on W contacts, (c) $MoSe_2$ grown on Mo contacts, and (c) WSe_2 grown on W contacts.

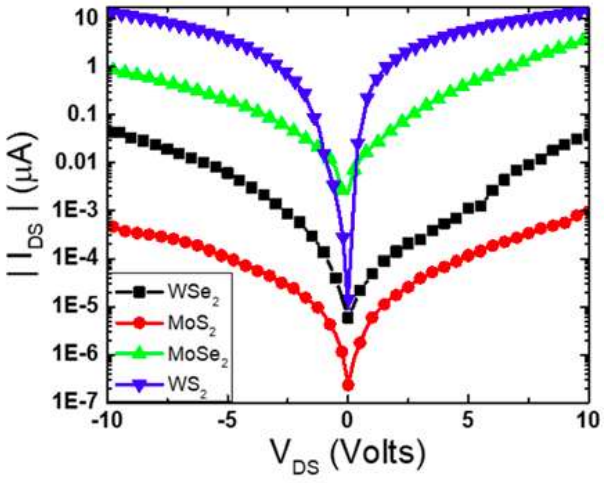

Figure 2: Current versus Voltage (IV) measurements demonstrate a Schottky contact, metal-semiconductor-metal