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GRAPHENE AND BEYOND
From Atoms to Applications

Controlled Growth of Atomically-Thin Semiconductor Films

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Abstract

The next generation of electronics and optoelectronics depend on new materials and methods that can be integrated with current technologies or reach beyond the capabilities of silicon based devices. Two-dimensional materials have emerged as promising candidates to achieve such goals. As is common for new materials, much of the early work has been focused on measuring and optimizing intrinsic properties on small samples (e.g., micromechanically exfoliated flakes). However, real-world devices and systems inevitably require large-area and highly-crystalline films that are integrated with other materials (e.g. dielectrics, other semiconductors and contacts). These requirements are particularly challenging due to the ultra-thin nature of 2D materials. In this talk I will describe our attempts to study the growth of transition metal dichalogenides (TMDs) via CVD-based (MOCVD, HCVD, *etc.*) methodologies. High crystallinity films might be obtained by controlling the nucleation density, and thus the domain size, or/and *via* epitaxial growth, which in 2D materials is referred as van der Waals (vdW)- (2D on 2D) or quasi-vdW epitaxy (2D on 3D). Our strategies to achieve both will be described. Finally, the vdW epitaxial growth of TMDs at low temperatures and other current projects will be briefly discussed as well.