Engineered growth of two-dimensional transition metal dichalcogenides for electronic and optoelectronic applications

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Recently, there has been significant research interest in atomically thin, semiconducting two-dimensional transition metal dichalcogenides (TMDs) due to their potential in high-performance ultrathin electronic and optoelectronic devices. To realize these applications and drive the advancement of 2D semiconductors towards commercial implementation, it is crucial to develop large-area growth methods that provide precise control over the material quality, composition, and defect density. Additionally, a thorough characterization of the grown materials at the atomic scale is necessary to fully understand their physical and chemical characteristics as well as to establish structure-property relationships. In this presentation, I will provide an overview of our recent research efforts in scalable synthesis, characterization, engineering, and device applications of semiconducting TMDs, including high-quality monolayer single crystals, TMD1-TMD2 lateral heterostructures, and Janus TMDs. I will also demonstrate their potential in various atomically thin device applications, such as highresponsivity phototransistors, rectifiers, photovoltaic devices, photonic devices, optical fiber-based devices, and electroluminescent light emitters.

References:
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