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CVD Synthesis of 2D-MoS_2 for Heterostructure Development in Optoelectronic Devices

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Molybdenum disulfide (MoS_2), a two-dimensional transition metal dichalcogenide with a direct bandgap in its monolayer form, presents significant potential for a wide range of applications in optoelectronics. The heterostructure formed by combining MoS_2 with gallium nitride (GaN), a wide-bandgap semiconductor characterized by high electron mobility, thermal stability, and favorable optical properties, offers a platform for the development of advanced electronic device architectures.
This work details the synthesis of high-quality MoS_2 monolayers via Chemical Vapor Deposition (CVD) utilizing liquid precursors. The proposed method enables the formation of uniform, large-area MoS_2 flakes with precise control over thickness, morphology, and crystallinity, presenting a scalable approach for the integration of 2D materials. In addition, a process for transferring MoS_2 grown on SiO_2/Si to GaN substrates is introduced and compared with the direct growth of MoS_2 on GaN.
Furthermore, we present preliminary exploratory results on the integration of MoS_2 into photonic structures, specifically bullseye cavities, to enhance light-matter interaction via the Purcell effect. This integration highlights the potential of MoS_2 for photonic devices, where its unique optical properties can be leveraged to achieve enhanced control over light emission.
The future outcomes of this study aim to demonstrate the versatility of CVD-grown MoS_2 for high-performance optoelectronic applications.

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