**TWO-STEP WAFER SCALE CHEMICAL VAPOR DEPOSITION OF GRAPHENE/H-BN HETEROSTRUCTURES**

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**ABSTRACT**

The wealth of two-dimensional materials (2D) has piqued researchers' interest due to the abundance in options for adjustable electrical, optical, and chemical characteristics. Furthermore, heterostructures based on these materials can blend numerous exotic properties and establish a unique platform for creating an essentially endless number of combinations [1]. In order to benefit from these advantages, methodologies for the scalable preparation of high-quality, low-cost 2D materials and heterostructures are in great need. Despite various limitations and challenges, chemical vapor deposition (CVD) is a potent procedure that can satisfy the aforementioned requirements and has been widely utilized to construct 2D materials and associated heterostructures in the recent years [2]. Albeit research in CVD synthesis has progressed rapidly, wafer-scale production of 2D heterostructures is still a daunting task, especially on insulating substrates [3].

In this study, we present a methodology to achieve wafer-scale synthesis of 2D heterostructures, taking graphene/h-BN as an example. By taking advantage of the inevitable out-of-plane deformations arising from the cooling down after each CVD step and carefully engineering the process, we readily attain wafer-scale production. The combined corrugations from two CVD steps result in a 2D heterostructure of increased bending stiffness. The properties of the final product are probed extensively with Atomic Force Microscopy (AFM) in the form of topography, work function, conductivity distribution and tribological characteristics. This work disentangles the thought pathways for successful wafer scale CVD synthesis of 2D heterostructures and overlays a rationale for their industrial integration.

**KEYWORDS:** Chemical Vapor Deposition, wafer-scale, heterostructures, 2D materials

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