Growing Large-Area 2D Materials: Prospects and Challenges

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Abstract

In the past decade, there has been a remarkable surge in research advancements concerning ultrathin two-dimensional (2D) nanomaterials within the domains of condensed matter physics, materials science, and chemistry. This surge can be attributed to the discovery of graphene, which was obtained through the exfoliation of graphite in 2004[1]. The development of large-scale, single crystalline two-dimensional (2D) materials on wafer substrates is crucial for the advancement of 2D-materials-based electronics in industrial applications[2]. The properties of 2D materials depend on the specific production methods employed, underscoring the importance of understanding growth kinetics and developing synthetic methods to harness their full potential[3]. Therefore, this seminar will discuss typical synthetic methods, providing comments on their advantages and disadvantages. Both exfoliation techniques, such as mechanical and liquid exfoliation for isolating thin layers from bulk materials, and bottom-up methods like chemical vapor deposition (CVD), will be covered. Various types of CVD, including atmospheric pressure CVD (APCVD) and ultra-high vacuum CVD (UHV-CVD), will also be discussed, highlighting their distinct growth mechanisms and applications.

Keywords: 2D materials, mechanical exfoliation, liquid exfoliation, CVD, UHV

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