Understanding and characterization of few-layer hexagonal boron nitride grown via atmospheric pressure chemical vapor deposition

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Hexagonal boron nitride (h-BN), or white graphene, has recently become an attractive platform for room-temperature quantum photonics due to the discovery of robust visible single-photon emitters [1]. Nowadays, two-dimensional h-BN material is often used in van der Waals heterostructures. It has a wide bandgap (6 eV), which hosts numerous optically active structural defects [2,3]. In this work, atomically thin h-BN was grown on Cu foil by atmospheric-pressure chemical vapor deposition (APCVD) using ammonia borane (AB) powder as a precursor. Then, it was transferred onto SiO_2/Si substrates via a wet chemical method. The samples were extensively characterized via Raman spectroscopy, X-ray photoelectron spectroscopy, Total internal reflection fluorescence and Atomic force microscopy. The h-BN samples consist of a few layers with about 7 nm thickness (Figure 1). The emitters observed exhibit a blinking with “on" and "off" states. Furthermore, the preliminary tests performed for both low and high regimes of argon flow used during the AB pre-treatment showed approximately similar surface chemical compositions in h-BN thin films. It is therefore crucial to comprehend the APCVD development process and to modify parameters such as growth temperature, precursor concentration, gas flows, substrates, etc. This understanding helps us to accelerate h-BN production, aiming to get atomically thin h-BN with good qualities.

Keywords: 2D h-BN material, Atmospheric-pressure chemical vapor deposition, Blinking.

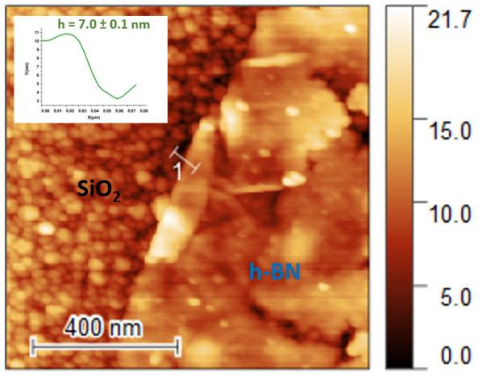

Figure 1: AFM image of the h-BN thin film deposited using APCVD. The inset image corresponds to the thickness measurement.

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