

Large area synthesis of hexagonal boron nitride (hBN) with controlled thickness and crystal shape

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After experimental isolation of graphene in 2004 [1], a lot of research has been focused on study of wide range of two-dimensional materials. Among these materials hexagonal boron nitride (hBN) has been studied recently due to its excellent properties like high transparency, mechanical strength and thermal conductivity. hBN consist of alternating B and N atoms forming honeycomb lattice like graphene [2]. Due to almost identical lattice structure with that of graphene and lack of dangling bond and charge traps makes hBN best substrate for graphene electronics. CVD synthesis of hBN is studied for fabrication of large area, high quality films.

In this work we report the large area synthesis of hBN on Cu foil using ammonia borane as precursor in atmospheric pressure CVD. Our system consists of single furnace with precursor kept in a magnetic boat. Varying the distance between and growth zone and magnetic boat can control heating rate of precursor. Prior to synthesis of hBN, Cu foil was annealed at 1020⁰ C in H₂ atmosphere to reduce impurity and roughness. During growth H₂ was significantly reduced and Ar was introduced as carrier gas. Experimental conditions are optimized for synthesis of monolayer and bilayer films. hBN crystals with triangular, hexagonal and diamond shape has been observed. Synthesized hBN was high quality confirmed using XPS, SEM, TEM, Raman spectroscopy and optical microscopy. This method of hBN synthesis is significant compared to other reported method, as crystal size, shape and number of layers are precisely controllable.

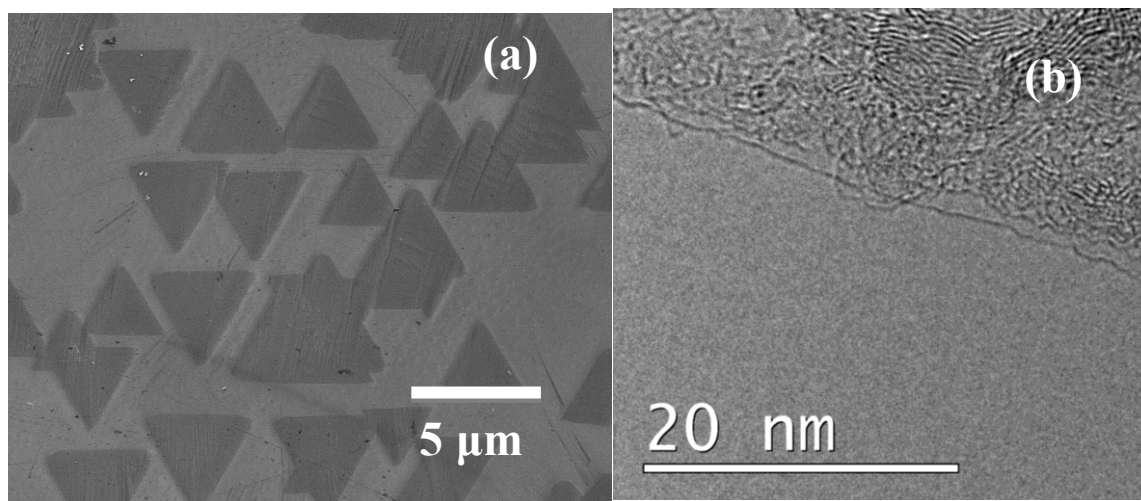


Figure: (a) Triangular hBN crystal and (b) TEM characterization of monolayer hBN

References:

1. Novoselov, K. S. et al. Science **306**, 666 (2004).
2. Liu, L et al. Physical Review B **68**, 104102 (2003).