Hexagonal Boron Nitride Grown on Graphite by High Temperature Molecular Beam Epitaxy

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Multilayer heterostructures based on graphene and hexagonal boron nitride (hBN) have been intensively investigated in recent years. To date most examples of such heterostructures have been fabricated by stacking high quality exfoliated layers on top of each other. To realize vertical superlattice structures epitaxial growth of such heterostructures would be advantageous. We have previously demonstrated that graphene can be grown on hBN by high temperature MBE [1]. In this paper we demonstrate direct epitaxial growth of high-quality hexagonal boron nitride layers on highly oriented pyrolytic graphite using high temperature plasma-assisted molecular beam epitaxy [2]. X-ray photoelectron spectroscopy, Raman microscopy and spectroscopic ellipsometry confirm the formation of sp^2-bonded hBN with a band gap of 5.9 ± 0.1 eV [2].
AFM reveals mono- and few-layer island growth [Fig 1(a)]. Islands ~200-400 nm in size have been grown with an overall coverage of ~92%. Conducting AFM shows that the MBE-grown hBN has a resistance which increases exponentially with the number of layers [Fig 1(b) and (c)]. The current decays by a factor ~ 40 per hBN layer comparable to that observed on exfoliated hBN [3].
Hexagonal moiré patterns with a period of 15nm, consistent with the alignment of the hBN lattice and graphite substrate have also been observed. The current work is an important step towards the epitaxial growth of complex graphene/hBN heterostructures.

References

[1] A. Summerfield et al, *Sci. Rep.* **6** (2016) 22440.
[2] Y. Cho, et al, *Sci. Rep.* **6** (2016) 34474
[3] L. Britnell, et al, *Nano Lett.* **12** (2012) 1707.

Figures

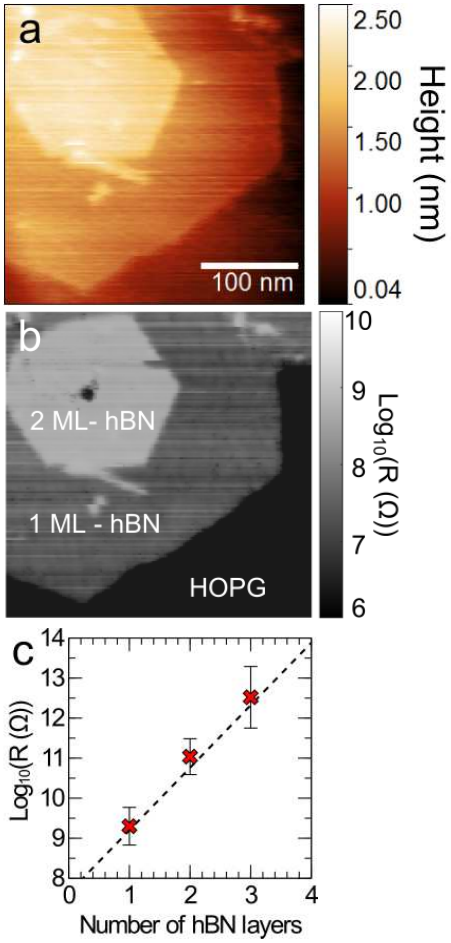

Figure 1: (a) Topographic and (b) conducting AFM images (c) vertical resistance as a function of hBN layer thickness.