Properties of Atomically Precise Vacancies in Novel Bernal-Stacked Hexagonal Boron Nitride

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The relative orientation of successive sheets, i.e. the stacking sequence, in layered two-dimensional materials is central to the electronic, thermal, and mechanical properties of the material. In hexagonal boron nitride (h-BN), though Bernal (AB) stacking is predicted to have similar cohesive energy to the common AA' stacking, no synthetic method has been demonstrated for this material at large scales.

In this presentation, we (1) present a scalable modified chemical vapor deposition method that produces large flakes of virtually pure AB stacked h-BN,[1] (2) describe the properties of this new materials, and (3) demonstrate how Bernal stacked h-BN is the ideal material for creating vacancies with atomic precision.[2] This work represents the first experimental realization of the synthesis of pure AB-stacked h-BN and represents an important realization in controlling the vacancies in layered materials.

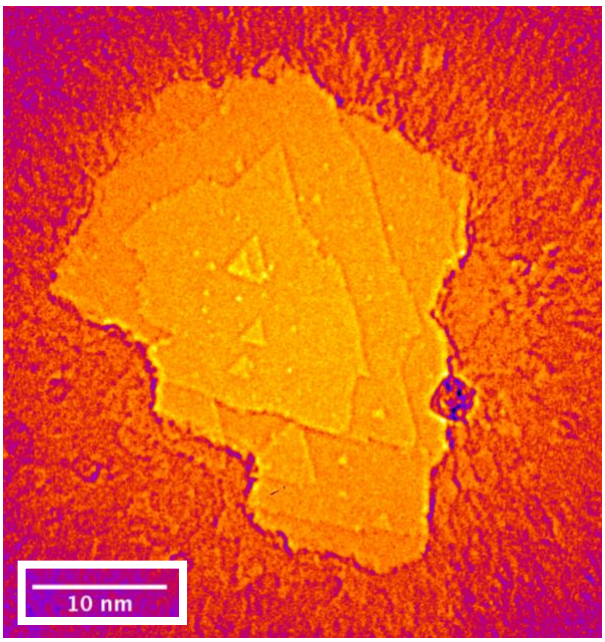

Figure 1: A single ~1.5 nm pore fabricate in Bernal-stacked hexagonal boron nitride

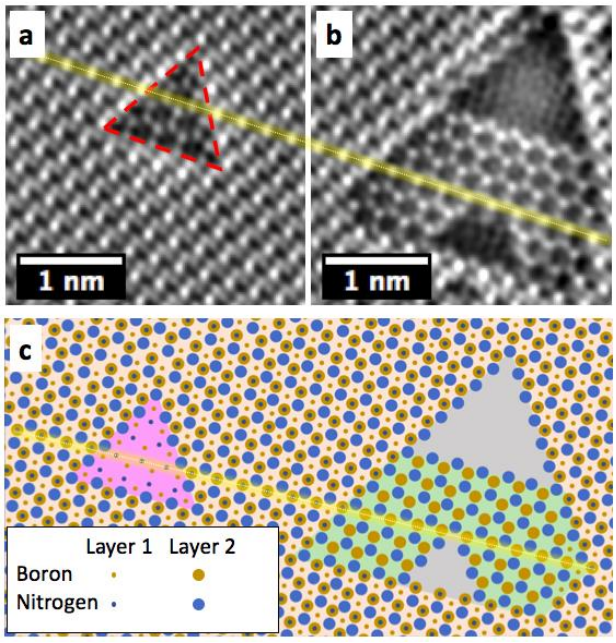

Figure 2: High resolution TEM image (a) (b) from two nearby regions in a bilayer AB-stacked h-BN with their schematic (c).

References

[1] S.M. Gilbert, T. Pham, M. Dogan, S. Oh, B. Shevitski, G. Schumm, S. Liu, P. Ercius, S. Aloni, M.L. Cohen, and A. Zettl, *Under Review/Arxiv* (2018).
[2] S.M. Gilbert, G. Dunn, A. Azizi, T. Pham, B. Shevitski, E. Dimitrov, S. Liu, S. Aloni, and A. Zettl, Sci. Rep. **7**, 15096 (2017).

Figures