Ferroelectricity in hexagonal boron nitride

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Two-dimensional (2D) hexagonal boron nitride (hBN) is a wide-bandgap van der Waals crystal with a unique combination of properties, including a honeycomb lattice very close to that of graphene, exceptional strength, high oxidation resistance at high temperatures and optical functionalities [1]. As a result, it has become a ubiquitous material for the fabrication of van der Waals heterostructures [2]. Like many Group III nitride materials, its covalent bonds are highly polar, presenting the possibility of piezoelectricity [3] and spontaneous polarizations in the correct crystal configurations. In this talk, I will present the occurrence of spontaneous out-of-plane polarization forming ferroelectric-like domains at anomalously stacked hBN interfaces [4]. We have observed these effects using atomic force microscopy (AFM) electrical modes, namely electrostatic (EFM) and Kelvin Probe (KPFM) Force Microscopy, in combination with detailed modelling of in-plane deformation profiles and interface relaxation. Both the in-plane piezoelectricity and the out-of-plane ferroelectricity presented here open up interesting possibilities for precise control of device properties. The experimental approach used here also shows a way to investigate the polarization properties of other materials at the nanoscale.

References

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Figures

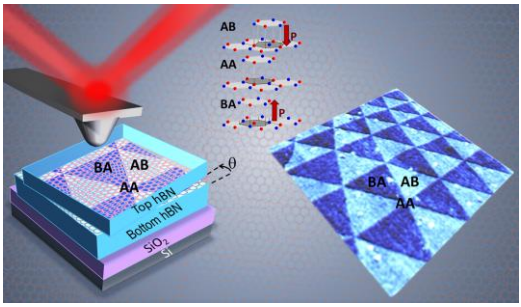

Figure 1: Ferroelectric-like domains in hBN