

Atomic Encoding in a Sliding Ferroelectric van der Waals Heterostructure

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Recently, out-of-plane ferroelectricity has been observed in aligned structures of hBN and transition-metal dichalcogenides (TMD's) [1-4]. Here, switching between polarisation states is dictated by a net shift of adjacent layers equal to $1/\sqrt{3}$ of the lattice parameter. In this work, we induce sliding in a ferroelectric hBN structure by applying uniaxial strain using a piezoelectric substrate. Through in situ electrostatic force microscopy (EFM) imaging, we observe full, repeated, and controllable electric switching of the sliding area. The frequency of switching events provides evidence of atomic-scale displacement encoding, which indicates its potential use in future displacement sensing applications. Multiscale modelling of dislocation energetics coincides with experimental observations of their propagation, highlighting the role of Burgers vector selection in governing switching behaviour.

References

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Figures

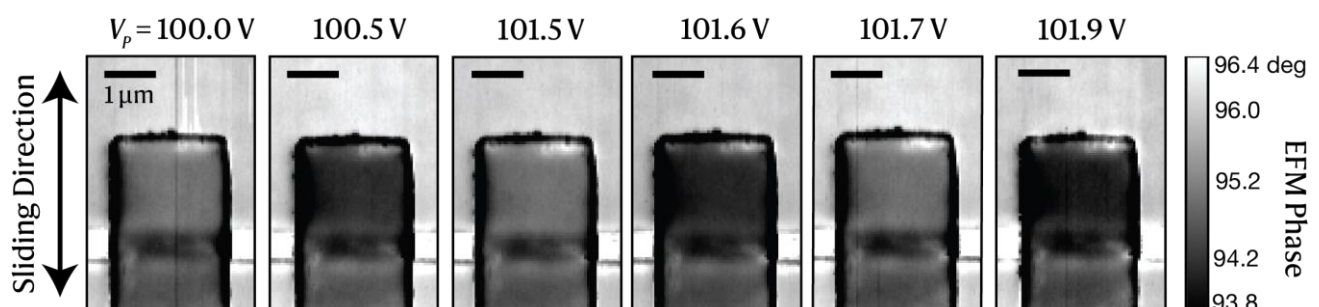


Figure 1: EFM phase images of a sliding ferroelectric hBN structure on a piezoelectric substrate. By increasing the applied piezo voltage, the substrate expands and induces sliding in the top hBN crystal, resulting in an inversion of the interfacial polarisation.