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Intrinsic Ferroelectric Switching in 2D CuInP_2S_6

Two-dimensional (2D) ferroelectric materials are promising candidates for next-generation nanoelectronic and non-volatile memory devices. Reliable electrical characterization at the nanoscale remains challenging. In this work, we investigate the ferroelectric properties of layered CuInP_2S_6 (CIPS) using a modified conductive atomic force microscopy (C-AFM) approach. CIPS flakes were mechanically exfoliated onto a conducting gold (Au) substrate, followed by the transfer of few-layer graphene (FLG) on top, forming an Au/CIPS/FLG van der Waals heterostructure. Au serves as the bottom electrode, FLG acts as the top contact, and CIPS functions as the ferroelectric layer. Due to the small lateral dimensions of the FLG electrode, a conducting AFM tip was employed to establish a precise electrical connection to the FLG, enabling localized ferroelectric measurements. The conducting tip was interfaced with a ferroelectric tester to probe the electrical response of the heterostructure. Frequency-dependent polarization–electric field (P–E) hysteresis loops were measured under various electric field sweeps, along with current–voltage characteristics. Additionally, positive-up–negative-down (PUND) measurements were performed to distinguish intrinsic ferroelectric switching from non-ferroelectric contributions. The observed hysteresis behavior and PUND response confirm the intrinsic ferroelectric nature of 2D CIPS and demonstrate the effectiveness of the modified C-AFM technique for probing nanoscale ferroelectricity.

Academic or Professional Status

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