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Characterization Of Graphene-Ferroelectric Superlattice Hybrid Devices[1] MOHAMMED YUSUF, XU DU, MATTHEW DAWBER, Dept of Physics and Astronomy, Stony Brook University — Ferroelectric materials possess a spontaneous electrical polarization, which can be controlled by an electric field. A good interface between ferroelectric surface and graphene sheets can introduce a new generation of multifunctional devices, in which the ferroelectric material can be used to control the properties of graphene. In our approach, problems encountered in previous efforts to combine ferroelectric/carbon systems are overcome by the use of artificially layered superlattice materials grown in the form of epitaxial thin films. In these materials the phase transition temperature and dielectric response of the material can be tailored, allowing us to avoid polarization screening by surface absorbates, whilst maintaining an atomically smooth surface and optimal charge doping properties. Using ferroelectric $PbTiO_3/SrTiO_3$ superlattices, we have shown ultra-low-voltage operation of graphene field effect devices within $\pm$ 1 V at room temperature. The switching of the graphene field effect transistors is characterized by pronounced resistance hysteresis, suitable for ultra-fast non-volatile electronics. Low temperature characterization confirmed that the coercive field required for the ferroelectric domain switching increases significantly with decreasing temperatures.

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