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Electric field effect modulation and hysteresis in thin graphite using ferroelectric gate oxides X. HONG, K. ZOU, J. ZHU, Department of Physics, Penn State University, A. POSADAS, J. REINER, C. H. AHN, Department of Applied Physics, Yale University — We study the electronic properties of thin graphite field effect transistors (FETs) using ferroelectric gate oxide Pb $(Zr,Ti)O_3$ (PZT). Thin graphite flakes (3-5nm) are exfoliated onto 300 nm PZT films epitaxially grown on doped $SrTiO_3$ (STO) and fabricated into FET devices. Carriers are induced into the FETs by applying a voltage V_g on the STO substrate (backgate). We observe a maximum carrier density (n) of $\sim$4x10^{13}cm^{-2} and a density modulation of $\sim$2x^{12}cm^{-2}/V$_g$(V), and extract a high dielectric constant $\sim$100 of PZT. We also explore the potential of non-volatile memory devices based on the large polarization of PZT ($\sim$40 μC/cm^2) and its field switching behavior. At 300 K, both the resistance and n of the devices show pronounced hysteretic behavior as V_g is swept beyond 3 V, with two distinct states. The unstable one decays exponentially with time, with a time constant of $\sim$6 hours at 300 K and a few days at 150 K, suggesting a thermally activated process. We discuss possible origins of the hysteresis, highlighting the importance of adsorbates at the interface of PZT and graphite.

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