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Ferroelectric Controlled Nanoscale MoS_2 Transistor ZHIYONG XIAO, JINGFENG SONG, STEPHEN DUCHARME, XIA HONG, University of Nebraska - Lincoln — We report the study of the device characteristics of MoS_2 field effect transistors with a SiO_2 backgate and a ferroelectric polymer top gate. We mechanically exfoliated MoS_2 flakes on 300 nm SiO_2 substrates. The thinner MoS_2 pieces were identified by Raman spectroscopy and atomic force microscopy (AFM), and flakes of 1 - 5 nm thick were fabricated into two point devices via e-beam lithography with Ti/Au (5nm/50nm) as the contact electrodes. We then deposited on the top of the device a ferroelectric polymer layer, 20-40 nm polycrystalline poly(vinylidene-fluoride-trifluorethylene) (PVDF-TrFE), using the Langmuir-Blodgett approach. At room temperature, we achieved a current modulation of a factor of 10^3 using the SiO_2 back gate. The field effect mobility of the devices is $\sim$ 20 $cm^2V^{-1}s^{-1}$. We then used conducting AFM to control the polarization of the top ferroelectric gate, and examined the SiO2-gated I-Vg characteristics in different polarization states of PVDF-TrFE. By switching the ferroelectric polarization, we induced a 30 V shift in I-V_g. At fixed backgate voltage, we achieved a maximum switching ratio in the drain current of $\sim$ 15.

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