Characterization of Ferroelectric Order in 3R-MoS_2

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Ferroelectrics provide a promising route for non-volatile memory, energy-efficient logic devices, and tunable components like capacitors and sensors, through their switchable electrical polarization. Two-dimensional (2D) ferroelectrics give us the opportunity to exploit these applications at atomically-thin scales. Here we present a study of ferroelectricity in 3R-MoS_2, a sliding ferroelectric which has been receiving a lot of attention in the past years[1]. Few layer samples present an out of plane electric polarization depending on the stacking order of the layers. We employ piezo-force microscopy (PFM) and photoluminescence measurements to probe the ferroelectric order with different methods, such as the variation of excitonic features with different stacking orders. In order to gain insights on the electrical switching of this material, we performed poling and PFM measurements with tip biases up to 10 V. Even up to these high biases we were unable to observe a switching of the ferroelectric order indicating that the ferroelectric switching barrier in the absence of domain walls is too high for practical applications. We will also show our ongoing work on the electrical switching of the ferroelectric order for samples in the presence of domain walls, using photoluminescence measurements.

References

[1] Dongyang Yang et Al., Nature Communications, 15 (2024) 1389

Figures

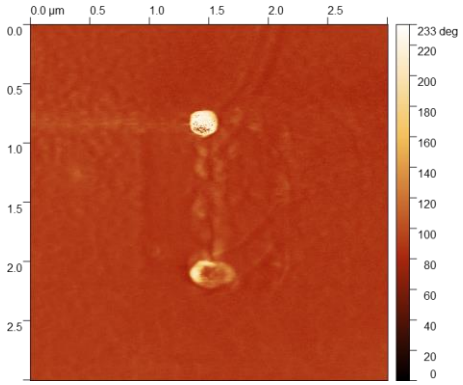

Figure 1: PFM measurement on 3R-MoS_2 after poling.

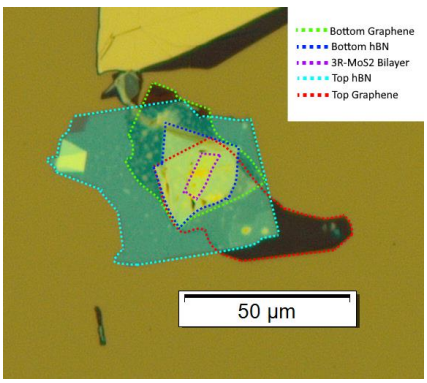

Figure 2: 3R-MoS_2 gated device.