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Scanning tunneling microscopy of gate tunable topological insulator Sb2Te3 TONG ZHANG, NIV LEVY, JEONGHOON HA, Center for Nanoscale Science and Technology, NIST/Maryland NanoCenter, UMD, YOUNG KUK, Dept. of Physics and Astronomy, Seoul National University, JOSEPH STROSCIO, Center for Nanoscale Science and Technology, NIST — We achieved gate tunable topological insulator (TI) Sb2Te3 thin films which are suitable for low temperature scanning tunneling microscopy (STM) studies. The film is epitaxially grown on pre-patterned SrTiO3 substrates which are mounted on specially designed sample holders. This allows us to do in-situ gating on epitaxial films without any ex-situ processing of the sample. The tunneling conductance as well as film resistance is investigated as a function of gate voltage (Vg). In a 3 nm thick Sb2Te3 film, a gap opening at the Dirac point due to the coupling of the top and bottom surfaces is observed. More importantly, the gap size is found to be tunable by Vg, a result of the combination of coupling of the surface state bands and electric field effect. We show that our observation can be well described by an effective model of TI thin films and first principle calculations. The reduced surface states gap versus Vg indicates it is possible to create a topological phase transition by apply a strong enough electric field through the film.

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