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Characterization of Chemical Trends in Magnetically Doped, Electrically Gated Topological Insulator Thin Films ANTHONY RICHARDELLA, ABHINAV KANDALA, JOON SUE LEE, ROBBIE FRALEIGH, NITIN SAMARTH, Dept. of Physics, Penn State University, MINHAO LIU, NAI PHUAN ONG, Dept. of Physics, Princeton University, JING TAO, Brookhaven National Laboratory — Interfacing topological insulators (TIs) with magnetism breaks time reversal symmetry and opens a gap in the surface states at the Dirac point. This results in novel phenomena, such as the recently reported quantized conductance at zero applied external magnetic field due to the quantum anomalous Hall effect (QAHE) in Cr doped $(Bi_xSb_{1-x})_2Te_3$ [C-Z. Chang, et al., Science 340, 167 (2013)]. We have studied magnetically doped $(Bi_xSb_{1-x})_2Te_3$ thin films grown by MBE on SrTiO3(111) (STO) substrates using Cr, Fe and Mn as magnetic dopants and as a function of the Bi and Sb composition. These films are carefully characterized by XRD, AFM, SQUID magnetometry and TEM. The chemical composition is determined using SIMS, RBS and XRF. Low temperature transport shows a large gate-tunable Hall effect in Cr doped samples and systematically varying longitudinal magneto-conductance as the Fermi energy is tuned through the Dirac point. The origin of ferromagnetism and its dependence on the chemical potential, chemical composition and sample thickness is discussed. Funded by DARPA and ARO-MURI.

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