Abstract Submitted
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Scanning tunneling spectroscopic (STS) studies of magnetically doped MBE-grown topological insulators (TIs)[1] HAO CHU, MARCUS TEAGUE, CHIEN-CHANG CHEN, NICHOLAS WOODWARD, NAI-CHANG YEH, California Institute of Technology, XUFENG KOU, LIANG HE, MURONG LANG, KANG LONG WANG, UCLA, CALTECH COLLABORATION, UCLA COLLABORATION — We conduct STS studies on MBE-grown heterostructures of non-magnetic TI (Bi_2Se_3) with a range of thicknesses ($d = 1, 3, 5, 7$ quintuple layers, QL) on top of 7-QL magnetically doped TI (Cr-doped Bi_2Se_3). For $d = 1$ and 3-QL, a spatially homogeneous magnetism-induced surface gap (as large as about 150 meV for $d =$ 1-QL) is observed at 77 K, whereas gapless Dirac spectra are found for $d =$ 5 and 7-QL, suggesting that the effective magnetic length for Cr-doped Bi_2Se_3 is approximately $4 \sim 5$-QL. These findings are further corroborated by ARPES and bulk electrical transport measurements. The magnetism-induced surface gap differs from those found in pure Bi_2Se_3 and $(Bi_{0.5}Sb_{0.5})_2Te_3$ films of thicknesses smaller than 6-QL, because the latter are due to overlaps of wave functions between the surface and interface layers, which lead to Rashba-like spin-orbit splitting and spin-preserving quasiparticle interference wave-vectors. In contrast, STS studies of TIs with magnetism-induced surface gap do not yield any quasiparticle interferences for energies within the bulk Bi_2Se_3 gap. Finally, comparative STS studies of pure and magnetically doped TIs in high magnetic fields will be discussed.

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