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Magnetic Doping Effects on the Surface State (SS) of Topological Insulators (TIs): Comparison between MBE-grown Bi_2Se_3 and $(Bi,Sb)_2Te_3$ bilayer samples[1] CHIEN-CHANG CHEN, ANKIT KUMAR, NAI-CHANG YEH, Dept. of Physics, Caltech, LEI PAN, KOICHI MURATA, KANG L. WANG, Dept. of Elec. Eng., UCLA — We report studies of MBE-grown bilayer structures with one quintuple layer (QL) of pure TI on top of 6-QL of Cr-doped TI. Here TI is either Bi_2Se_3 or $(Bi,Sb)_2Te_3$. For 10% Cr-doping, both systems exhibited a similar bulk Curie temperature T_c^{3D} $\sim$35 K from the onset of anonymous Hall effect (AHE). However, the AHE was much weaker in the Bi_2Se_3 system. Scanning tunneling spectroscopic (STS) studies revealed a gap opening in the SS below T_c^{2D}($>\sim$210 K) for both systems, but the gap in the Bi_2Se_3 system was much more inhomogeneous, probably due to larger lattice strain variations from Cr doping. Given that the SS gap only opens under out-of-plane long-range magnetization, strain variations could induce varying orientation of magnetic domains, thus the appearance of gap inhomogeneity. Double spectral resonances associated with topological spin textures around isolated magnetic impurities were also observed along the boundaries of gapped and gapless regions only in the Bi_2Se_3 system. Theoretically finite coupling among these isolated topological spin textures could be induced by tuning the Fermi level of the TI away from the Dirac point. We shall verify this prediction by studying the spectral evolution of the double resonances in the Bi_2Se_3 system with a backgate voltage.

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