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Low-temperature magnetoresistance in electrically gated Bi_2Se_3 thin films J.S. LEE, A.M. DASILVA, A. RICHARDELLA, D.M. ZHANG, J.K. JAIN, NITIN SAMARTH, Dept. of Physics, Penn State University, University Park PA 16802 — Although transport in samples of 3D topological insulators often has a large contribution from bulk conduction, the surface transport can be studied by electrical gating of topological insulator thin films. We have measured thin films of Bi_2Se_3 grown by molecular beam epitaxy and subsequently photolithographically patterned with a high$-\kappa$ gate dielectric (HfO_2) using atomic layer deposition. Gate voltage-dependent Hall effect and magnetoresistance were measured over a temperature range $0.5K \leq T \leq 20$ K in both perpendicular and parallel magnetic fields up to 6 T. Applying a negative gate voltage forms a depletion layer at the top of the thin film and decouples the surface from bulk carriers. We use the weak antilocalization effect at low magnetic field to study the transport contribution of surface and bulk channels. We also discuss scattering mechanisms contributing to surface and bulk conduction. Supported by ONR and NSF-MRSEC.

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