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Growth and characterization of molecular beam epitaxial Bi2Se3 films and heterostructures[1] ZHIYI CHEN, THOR GARCIA, JOEL JESUS, LUKAS ZHAO, HAIMING DENG, JEFF SECOR, MILAN BEGLIARBEKOV, LIA KRUSIN-ELBAUM, MARIA TAMARGO, The City College of New York — Significant bulk conduction in the bulk of topological insulators (TIs) has been a major challenge in the studies of the their spin-helical Dirac surface conduction channels, a problem particularly severe in charge transport. Growth of high quality low-carrier concentration TI films is crucial not only for the fundamental study of TIs, but also for manufacture of heterostructures and devices. Here we report our results on synthesis and characterization of high-quality Bi_2Se_3 films grown using molecular beam epitaxy (MBE). A superior surface topography (smoothness) of the MBE Bi_2Se_3 films was obtained by a suitable choice of buffer layers used. A precise control of layer thickness was achieved and layers with good uniformity and surface quality were obtained. Hall measurements showed the films to be n-type, with sheet carrier concentrations typically in the $6 \sim 9 \times 10^{12}\text{cm}^{-2}$ range. Using optimal growth conditions for the best quality Bi_2Se_3 films, magnetically doped Bi_2Se_3 and heterostructures such as Bi_2Se_3/ZnSe were also grown and characterized in transport and with optical measurements. Novel magnetically ordered insulating state induced by magnetic doping, and exotic effects at the interfaces will be presented.

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