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Electrical Transport Properties of Mn doped Bi_2Se_3 Thin Films
SERCAN BABAKIRAY, TRENT JOHNSON, PAVEL BORISOV, DAVID LEDERMAN, West Virginia University — Magnetic impurity doping in topological insulators manifest itself with a gap opening in the Dirac cone as a result of breaking the time reversal symmetry. Moreover, the magnetic impurities affect the structural and quantum transport properties of topological insulators by increasing the disorder and by changing the bulk charge carrier type, charge carrier density and Hall mobility. Here, we investigated the effect of Mn doping on the structural and electrical transport properties of Bi2-xMnxSe3 thin films which are 12 quintuple layers thick and grown on Al2O3 (0001) single crystal substrates via molecular beam epitaxy (MBE). Hikami-Larkin-Nagaoka (HLN) formalism was used to study the weak antilocalization (WAL). Increasing Mn doping concentration was found to increase the bulk charge carrier density and to decrease the Hall mobility. A decrease was also observed in the phase coherence length related to WAL as a function of Mn content x. Values of another WAL parameter, the pre-factor alpha, showed that the top and bottom surfaces were coupled through the bulk conducting channels. The temperature dependence of phase coherence length indicated the electrical transport was dominated by 2D electron-electron scattering for the undoped, and by bulk weak localization effects for the Mn doped samples, respectively.

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