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Weak antilocalization in $Bi_{2-x}In_xTe_3$ single crystals HANG CHI, QIANG LI, Brookhaven Natl Lab, CTIRAD UHER, University of Michigan — Bi_2Te_3 has recently been identified as one of the most promising systems with which to realize a three-dimensional topological insulator. However, the bulk, stoichiometric Bi_2Te_3 single crystals often exhibit p-type metallic electrical conduction due to the Bi_{Te}-type antisite defects, which overshadows the contribution of surface states. We have established that, upon group III (indium and/or thallium) doping, the Fermi level of Bi_2Te_3 can be lifted from the valence band into the band gap, and eventually shifted into the conduction band. Such doping progressively changes the electrical conduction of $Bi_{2-x}A_xTe_3$ (A = In, Tl, and $x = 0 - 0.30$) single crystals from p-type to n-type. This is observed via measurements of both the Hall effect and the Seebeck coefficient performed in the (0001) basal plane in the temperature range of $2 - 300$ K. At low levels, the temperature dependent in-plane electrical resistivity maintains its metallic character as the density of holes decreases. Heavier doping content, $x = 0.20$ (0.10) for In (Tl), drives the electrical resistivity into a prominent non-metallic regime displaying the weak anti-localization type of magnetoresistance at the lowest temperatures for $Bi_{1.80}In_{0.20}Te_3$. At the highest concentration, the samples revert back into the metallic state with electron dominated conduction. Thermal conductivity measurements of $Bi_{2-x}A_xTe_3$ single crystals, as examined by the Debye-Callaway phonon conductivity model, reveal a generally stronger point defect scattering of phonons upon doping.

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