Abstract Submitted
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Low Temperature Transport Properties of $Bi_{2-x}Tl_xTe_3$ Single Crystals[1] HANG CHI, CTIRAD UHER, University of Michigan, USA, PETR LOSTAK, CESTMIR DRASAR, University of Pardubice, Czech Republic — We show that Tl-doping progressively changes the electrical conduction of $Bi_{2-x}Tl_xTe_3$ (x =0−0.30) single crystals from p-type ($0 \leq x \leq 0.08$) to n-type ($0.12 \leq x \leq 0.30$), which is observed via measurements of both the Seebeck coefficient and the Hall effect performed in the crystallographic ab-plane in the temperature range of 2K-300K. The temperature dependent electrical resistivity in the ab-plane of $Bi_{2-x}Tl_xTe_3$ maintains its metallic character with the decreasing hole density at low doping levels of $0 \leq x \leq 0.05$. Heavier Tl-doping with $0.08 \leq x \leq 0.12$ drives the electrical resistivity into a prominent non-metallic regime, associated with characteristic metal-insulator-metal transitions upon cooling down from 200K. For even more Tl-doped samples, $0.20 \leq x \leq 0.30$, the system reverts back into the metallic state. Thermal conductivity measurements of $Bi_{2-x}Tl_xTe_3$ single crystals reveal a progressively stronger point defect scattering of phonon with the increasing Tl content. The systematic evolution of transport properties suggests that the Fermi level of Bi_2Te_3 which initially lies in the valence band (for x =0), is gradually shifted, with increasing Tl-doping, toward the top of the valence band (for $0.01 \leq x \leq 0.05$), then into the band gap (for $0.08 \leq x \leq 0.10$), and eventually into the conduction band (for $0.20 \leq x \leq 0.30$).

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