

Optical spectroscopy study on the normal-state properties of superconducting doped topological Insulator $\text{Cu}_x\text{Bi}_2\text{Se}_3$

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We present optical spectroscopy study on pure and Cu-intercalated Bi_2Se_3 crystals grown by self-melting technique. The pure Bi_2Se_3 shows a metallic optical response with a sharp plasma edge near 550cm^{-1} , being consistent with the ARPES measurement showing that the bulk electron-like band already crosses the chemical potential. The Cu-intercalated Bi_2Se_3 shows a superconducting transition near 3.8 K. Our optical spectroscopy measurement indicates that the plasma edge shifts substantially to higher frequency 1250cm^{-1} , indicating that Cu-doping supplies extra electrons to the system and further shifts the chemical potential up. Furthermore, our measurement revealed that the plasma edge shifts slightly to higher energies with decreasing temperature. The optical data yield useful information about the bulk electronic band structure of the superconducting doped topological Insulator $\text{Cu}_x\text{Bi}_2\text{Se}_3$ ($x=0.14$).