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Tuning optical and electrical transport properties of Bi2Se3 with Ca[1] ZHIYONG WANG, TAO LIN, PENG WEI, XINFEI LIU, Department of Physics and Astronomy, UC Riverside, RANDY DUMAS, KAI LIU, Department of Physics, UC Davis, JING SHI, Department of Physics and Astronomy, UC Riverside — We have systematically tuned the carrier type and density in Bi_2Se_3 single crystals by introducing a calcium dopant. By controlling Ca-concentration x in $Ca_xBi_{2-x}Se_3$, a minimum carrier density of $\sim 1 \times 10^{17}$ cm^{-3} is achieved in both n- and p-type materials. The Fourier transform infrared (FTIR) measurements were carried out in samples with different doping levels to obtain the inter-band transition energy, sample thickness, and the plasma frequency. The band gap and reduced effective mass of carriers were determined from the relation between the inter-band transition energy and carrier density. The undoped samples show a high electron density ($\sim 5 \times 10^{18}$ cm^{-3}) and the electrical resistivity shows a typical metallic behavior. At high magnetic fields (up to 14 T), the undoped samples show the Shubnikov-de Haas oscillations. Near the compensation point or x=1.2%, the electrical resistivity shows an insulating behavior with a low temperature saturation. This work was supported in part by DOE and NSF.

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