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Modification of topological insulator transport properties by electron beam irradiation[1] ZILONG JIANG, ZHIYONG WANG, TAO LIN, JING SHI, Department of Physics and Astronomy, University of California, Riverside, CA, 92521 — Topological insulators (TI) are predicted to present a variety of interesting surface transport phenomena. However, in TI devices, the metallic bulk conduction usually overwhelms the surface transport. In this work, we first fabricate TI devices based on our high bulk resistivity material ($\sim$5 Ω.cm) $Bi_xSb_{2-x}Te_ySe_{3-y}$ using ebeam lithography. Then we expose the devices with an electron beam to introduce disorders to localize the bulk carriers. The devices are $\sim$100-200 nm in thickness and the resistivity is weakly temperature dependent. Upon initial low-energy exposures, we find that the resistance of device decreases and reaches a saturation state as the dosage increases. We attribute this decrease in resistivity to an increased electron density in the devices. As we ramp up the energy of the electron beam, the resistance starts to increase, showing the effect of additional scattering. At low temperatures, the resistance rapidly increases in a diverging trend. At 4 K, the magnetoresistance starts to display oscillatory features that are likely the Shubnikov-de Haas oscillations from the surface states. We believe that the disorders introduced by the electron beam play an important role in modifying the transport of the bulk carriers. More detailed experimental results and discussions will be presented.

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