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Thickness Independent Surface Transport of Bi_2Se_3 on Al_2O_3(0001) Substrates NAMRATA BANSAL, Rutgers University, YONG SEUNG KIM, 3Graphene Research Institute, Sejong University, South Korea, MATTHEW BRAHLEK, ELIAV EDREY, SEONGSHIK OH, Rutgers University — The key requirement for exploiting the newly emerging three-dimensional (3D) topological insulators (TI) as a novel platform for coherent spin-polarized electronics is TI thin films with dominant surface transport properties. So far, while researchers have been able to observe the existence of surface states locally *in situ*, verification over a wide thickness range outside the growth chamber has not yet been reported. Here, we report large signature of surface transport in TI Bi_2Se_3 thin films. The Bi_2Se_3 films used for this study were grown on c-axis Al_2O_3 substrates with MBE. Hall-effect measurements in the standard Van der Pauw geometry provided clear evidence of two conducting channels for 4QL-2750QL thick samples, with the transport properties for one of the channel being thickness independent and the other varying with thickness. This thickness independent carrier density of $\sim 1.5 \times 10^{13}$ cm^{-2} has been observed over the entire thickness range down to 2 QL, clearly suggesting that this is due to surface states. Furthermore, another surface transport property directly related to the topological protection mechanism, the weak-antilocalization (WAL) effect, exhibited similar thickness- and bulk-independent characteristics.

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