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Emergence of Decoupled Surface Transport Channels in Bulk Insulating Bi2Se3 Thin Films MATTHEW BRAHLEK, NIKESH KOIRALA, MARYAM SALEHI, NAMRATA BANSAL, SEONGSHIK OH, Rutgers Univ — In ideal topological insulator (TI) films the bulk state, which is supposed to be insulating, should not provide any electric coupling between the two metallic surfaces. However, transport studies on existing TI films show that the topological states on opposite surfaces are electrically tied to each other at thicknesses far greater than the direct coupling limit where the surface wave functions overlap. Here, we show that as the conducting bulk channels are suppressed, the parasitic coupling effect diminishes, and the decoupled surface channels emerge as expected for ideal TIs. In Bi2Se3 thin films with fully suppressed bulk states, the two surfaces, which are directly coupled below $\sim$10 QL, become gradually isolated with increasing thickness and are completely decoupled beyond $\sim$20 QL. On such a platform, it is now feasible to implement transport devices whose functionality relies on accessing the individual surface layers without any deleterious coupling effects.

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