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Transfer of large-area MBE grown BiSefilms to arbitrary substrates NAMRATA BANSAL, Rutgers, State University of New Jersey, MYUNG R. CHO, Seoul National University, MATTHEW BRAHLEK, NIKESH KOIRALA, Rutgers, State University of New Jersey, YOICHI HORIBE, Kyushu Institute of Technology, JING CHEN, WEIDA WU, Rutgers, State University of New Jersey, YUN D. PARK, Seoul National University, SEONGSHIK OH[1], Rutgers, State University of New Jersey — Mechanical exfoliation of bulk crystals has been widely used to exfoliate thin topological insulator (TI) flakes to fabricate devices such as field-effect transistors. However, such a process produces only micro-sized flakes that are highly irregular in shape and thickness. In this work, we developed a process to transfer the entire area of TI Bi2Se3 thin films grown epitaxially on Al2O3 and SiO2 to arbitrary substrates. Ultrathin films of 4 quintuple layers (1 QL = 1 nm) with 1 cm x cm lateral size have been successfully transferred with no defects or cracks, as observed by optical microscopy. Transport measurements on the transferred films show that this process yields films with lower carrier concentrations and comparable or higher mobilities than before the transfer. Atomic force microscopy and transmission electron microscopy further confirm the pristine morphology and crystallinity of the transferred films. Furthermore, utilizing this process, we show that as the Fermi level is tuned into the proximity gap at the Dirac point of an ultrathin film, the film makes a clear metal-insulator transition with more than four orders of resistance change.

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