Electronic transport in MBE-grown $\text{Bi}_2\text{Se}_3$ topological insulator thin film field effect devices

TAI-LUNG WU, JIFA TIAN, HELIN CAO, YI XUAN, Department of Physics and Birck Nanotechnology Center, Purdue University, West Lafayette, IN 47907, XINYU LIU, JACK FURDYNA, Department of Physics, University of Notre Dame, Notre Dame, IN 46556, YONG P. CHEN, Department of Physics and Birck Nanotechnology Center, Purdue University, West Lafayette, IN 47907, QMD TEAM — Topological insulators (TI), such as $\text{Bi}_2\text{Se}_3$ and $\text{Bi}_2\text{Te}_3$, have attracted a lot of attention due to their exotic electronic properties. $\text{Bi}_2\text{Se}_3$ TI films grown by molecular beam epitaxy (MBE) are promising for studying the nature of topologically protected surface states due to their large size, high quality, the capability to tune the thickness and interface with various semiconductor substrates. In this study, thin films of $\text{Bi}_2\text{Se}_3$ have been grown on $\text{GaAs}$ (001) semi-insulating substrates in a III-V/II-VI dual chamber MBE system. To study the electronic properties, micrometer scale Hall-bar devices with high-$k$ dielectric ($\text{Al}_2\text{O}_3$) top gates have been fabricated. Systematical measurements of temperature dependent and electrical field modulated magneto-transport are performed to exam the conduction contributed by the surface states.

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