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Topological insulator properties of Bi_2Se_3 thin films grown by HPCVD RAJ KUMAR, Department of Materials Science and Engineering, North Carolina State University, Raleigh, NC, 27606, USA, JOSEPH E. BROM, JOAN M. REDWING, Department of Materials Science and Engineering, Pennsylvania State University, University Park, PA, 16802, USA, JINGYING WANG, DANIEL DOUGHERTY, Department of Physics, North Carolina State University, Stinson Drive, Raleigh, NC, 27695, USA, FRANK HUNTE, Department of Materials Science and Engineering, North Carolina State University, Raleigh, NC, 27606, USA
— Topological insulators (TIs) have a bulk band gap with conducting topological surface states (TSS) where conduction through these states is protected from impurity scattering by spin-momentum locking. Bi_2Se_3 thin films typically have a high n-type carrier concentration and show metallic behavior due to native defects such as Se vacancies. This makes it very difficult to directly observe the transport properties of the TSS in highly n-doped Bi_2Se_3 TI. We deposited Bi_2Se_3 thin films on (0001) Al_2O_3 by a hybrid physical chemical vapor deposition (HPCVD) technique which uses a high Se vapor pressure to reduce Se vacancies in the film. Magnetotransport measurements on these Bi_2Se_3 films showed metallic characteristics with n-type carriers and low carrier concentration. We clearly observed topological surface states in angle resolved photoemission spectroscopy (ARPES). The results of the characterization of these films by ARPES, XRD, XPS, AFM and magnetotransport are reported and discussed in the context of surface conductivity correlated with microstructure of Bi_2Se_3.

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