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Correlation of Lattice-Symmetry, Electronic Anisotropy and Transport in Topological Insulators Thin Films and Heterostructures FERHAT KATMIS, VALLA FATEMI, PENG WEI, HADAR STEINBERG, MIT, JOHN FREELAND, Argonne National Laboratory, PABLO JARILLO-HERRERO, JAGADEESH MOODERA, MIT — To explore the intrinsic features of topological insulators (TIs) thin films and thus to correlate structure with the exotic electronic properties as well as interaction with other material systems careful structural studies are needed. Molecular beam epitaxy ideally allows us to engineer the required system for observing the intrinsic properties of TI thin films and heterostructures, thereby accessing the optimum Dirac surface states. In well-defined films and heterostructures, we elucidated the role of imperfections e.g. vacancies, line defects, twinning etc., on the symmetry of the material that leads to internal atomic ordering by the decoration of the defects. Charge transport is seen to relate with film growth induced strain and relaxation, as well as exhibit strong directional dependence on the defect geometry. In TI with ferromagnetic insulator (FI), the observation of symmetry breaking strongly depends on the interface coupling between FI and TI, where the exchange interaction occurs defined by the hybridization at interface. Synchrotron based GIXRD, XAFS, and XAS/XMCD helped reveal strain, hybridization, and magnetic interaction between FI and TI thin films show strong structural and magnetic interactions. MIT MRSEC through NSF Grant No. DMR-0819762.

Ferhat Katmis
MIT

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