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Vacancy Reduction, Structural and Electronic Studies of Epitaxial Films of Topological Insulators[1] F. KATMIS, V. FATEMI, H. STEINBERG, L. ORONA, Department of Physics, MIT, Cambridge, USA, P. WEI, FBML, MIT, Cambridge, USA, P. JARILLO-HERRERO, J. MOODERA[2], Department of Physics, MIT, Cambridge, USA — We have developed methods for controlling the carrier concentration via a vacancy concentration reduction procedure in the MBE grown epitaxial topological insulator (TI) thin film on various substrates to reach the intrinsic features of TI. Our single crystalline TI thin films allowed us to systematically investigate the nature of coherent transport in this system. For structural characterization of TI thin films, various non-distractive methods, such as x-ray and electron based diffraction techniques, were used as a local probe to understand the long-, short-range atomic ordering and also lattice site occupation. Besides the improved electronic properties of the layers, as grown crystalline films density increased by 20% due to controlled vacancy reduction, determined by in-situ x-ray diffraction. Furthermore, correlation of vacancies and Se ion migration was observed to be the likely reason for lowering the carrier concentration. Our study also shows the dependence of carrier mobility and the vacancy concentration which has been optimized.

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