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Exploring Defects in Topological Insulators Using X-ray Diffraction and Atomic Force Microscopy MAEVE O'BRIEN, Univ of California - Merced, DR. ANTHONY RICHARDELLA, TIMOTHY PILLSBURY, PROFESSOR NITIN SAMARTH, Penn State — Topological insulators such as the Bi- and Sb- chalcogenides are of great interest to because they have unusual metallic surface states that allow the spin of electrons moving through them to be controlled and used for spintronic devices. Much progress has been made in the epitaxial growth of thin films of these materials. However, the common defects present need to be better characterized so that higher quality materials can be synthesized. Our aim was to better understand the structural defects present within the various topological insulators synthesized via molecular beam epitaxy. The methods used were primarily high-resolution x-ray diffraction and atomic force microscopy. These two techniques were used in conjunction in order to better understand both the surface defects and the defects present within the crystalline structure. The quality of the thin films is known to depend on the type of substrate the films are deposited upon. We report detailed characterization of Bi_2Se_3 grown on sapphire substrates and compare our results with those reported for growth on other substrates such as InP and $SrTiO_3$.

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