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X-ray diffraction Microscopy of Bi2Se3 thin film on graphene/SiC

NOUAMANE LAANAIT, ZHAN ZHANG, PAUL FENTER, Argonne National Laboratory — We present an x-ray diffraction microscopy study of a thin film of Bi_2Se_3 on epitaxial graphene/6H-SiC(001). The Bi_2Se_3 thin film, consisting of 30 quintuple layers (Se-Bi-Se-Bi-Se), is a topological insulator that was grown by molecular beam epitaxy. The x-ray microscope resolves the lateral distribution of the film thickness at the sub-100 nm scale with the contrast produced by the thin film diffraction signal. Utilizing the depth penetration of x-rays, we imaged the buried interfaces in this system, to probe the correlation between the structure and topography of the supporting interfaces and the growth of the thin film. We find that the Bi_2Se_3 thickness distribution closely follows the underlying substrate topography and is strongly affected by the inhomogeneous distribution of graphene near the steps of SiC, whereby nucleation induces the growth of a large number of carbon layers. High-resolution surface diffraction was also measured from this system to extract the atomic positions in the thin film to investigate the transition from graphene to Bi_2Se_3.

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