Quasi Van der Waals Epitaxy of Magnetic Topological Insulator on GaAs (111) Substrate

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Magnetic topological insulator could achieve quantum anomalous Hall (QAH) effect and spin-orbit torque (SOT) switching in the same structure. This is promising for its future applications in memory or switching applications with its robust surface properties by topological protection. In this work we have grown Cr:$(Bi_xSb_{1-x})_2Te_3$ and $MnBi_2Te_4$ on GaAs (111) substrate through modulation doping by MBE (Molecular Beam Epitaxy). The doping level and the thickness of each layer is examined to tune the bandgap and the Fermi level of the whole sample. In this way, we can tune the Fermi level into the bandgap and optimize the total resistivity to achieve quantization.

Considering the van der Waals nature of the epitaxial layers, it has very weak van der Waals bonding with the substrate. This gives rise to a quasi Van der Waals epitaxial growth mode at the interface of GaAs (111) and epitaxial layers. In this growth mode strain relaxes quickly within the 1st epitaxial layer. Growth mechanism and the influence on its transport properties are also discussed.

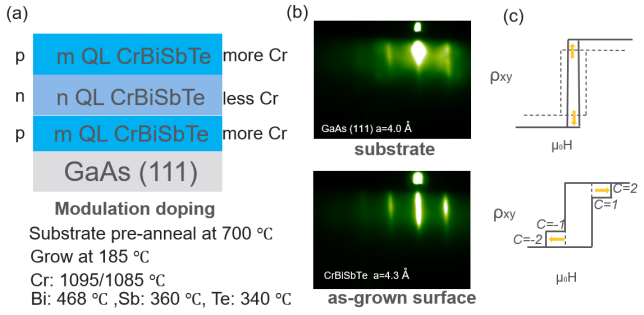

Figure 1 (a)sample structure; (b)RHEED pattern; (c)control of quantization

[1] Alaskar Y, Arafin S, Martinez-Velis I, Wang KL. Heteroepitaxial growth of III–V semiconductors on 2D materials. Two-dimensional Materials-Synthesis, Characterization and Potential Applications. 2016 Aug 31

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