Intermixing-driven ferromagnetism in the quantum anomalous Hall candidate $MnBi_6Te_{10}$

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The recent realizations of the quantum anomalous Hall effect (QAHE) in $MnBi_2Te_4$ and $MnBi_4Te_7$ benchmark the $(MnBi_2Te_4)(Bi_2Te_3)_n$ family as a promising playground for further QAHE improvements. The family owes its potential to its ferromagnetically (FM) ordered $MnBi_2Te_4$ septuple layers (SL). However, the QAHE realization is complicated in $MnBi_2Te_4$ and $MnBi_4Te_7$ due to the substantial antiferromagnetic (AFM) coupling between the SL. A ferromagnetic state, advantageous for the QAHE, can be stabilized by interlacing the SL with an increasing number *n* of Bi_2Te_3 quintuple layers (QL). In [1] we experimentally and theoretically establish the Mn/Bi intermixing as a new mechanism that can drive the FM state in $MnBi_6Te_{10}$, an intrinsic magnetic topological insulator [2] and QAHE candidate [3]. X-ray diffraction reveals an intermixing pattern of Mn/Bi that favors ferromagnetic coupling according to density functional theory (DFT) calculations. In consonance with these results, our samples show prominent ferromagnetic characteristics, with a rather large Tc ≈ 12 K and a substantial ordered, out-of-plane moment both in the bulk and at the surface [3]. Our results demonstrate that carefully engineered intermixing can accomplish a robust FM order and, therefore, is the key towards enhanced QAHE properties in the $(MnBi_2Te_4)(Bi_2Te_3)_n$ family of intrinsic magnetic topological insulators.

References

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Figures