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Ferromagnetism of vanadium doped Bi_2Se_3 thin films¹ LIGUO ZHANG, DAPENG ZHAO, YUNYI ZANG, YONGHAO YUAN, GAOYUAN JIANG, KE HE, XUCUN MA, QIKUN XUE, Department of Physics, Tsinghua Univ — Bi_2Se_3 is a representative three-dimensional topological insulator with a bulk band gap of about 300 meV. The quantum anomalous Hall effect (QAHE) has never been realized in Bi_2Se_3 -based magnetic topological insulators due to the difficulties in introducing ferromagnetism in them. With molecular beam epitaxy (MBE), we have grown vanadium-doped Bi_2Se_3 films with decent crystalline quality and homogeneous distribution of V impurities. The films are all electron-doped and show square-shaped hysteresis loops of Hall resistance with coercivity up to 0.2T at 2K, indicating ferromagnetism with perpendicular magnetic anisotropy in them. Both the ferromagnetism and anomalous Hall resistance are enhanced by decreasing electron density. We have systematically studied the magneto-transport properties of the films with varying V concentration, film thickness, and carrier density and discussed the mechanism of ferromagnetic coupling. The study demonstrates that V-doped Bi_2Se_3 films are candidate QAHE materials if their electron density can be further reduced.

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