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Critical Mechanism of Magnetic Doped $Cr_xBi_{2-x}Te_3$ Topological Insulator Thin Films[1] ZHEN ZHANG, YAN NI, RAVI HADIMANI, DAVID JILES, Department of Electrical and Computer Engineering, Iowa State University, CAJETAN NLEBEDIM, Ames Laboratory, US Department of Energy — Introducing magnetic dopants into topological insulators can lead to the opening of the surface band gap which can induce interesting phenomena such as the quantized anomalous Hall effect (QAH) and magnetoelectric effect. However, the critical properties of ferromagnetism in magnetic doped TIs are not well studied. In this work, we investigated the effect of magnetic doping on magnetic and transport response in Bi_2Te_3 thin films. $Cr_xBi_{2-x}Te_3$ thin films with x = 0.03, 0.14, and 0.29 were grown with low surface roughness ($\sim$ 0.4 nm). It is found that Cr is an n-type doping element, which reduces the carrier density of p-type Bi_2Te_3. Moreover, doping Cr induces long range ferromagnetism when x=0.14 and 0.29, where anomalous Hall effect and weak localization of magnetoconductance were observed. The Arrott-Noakes plot for $Cr_xBi_{2-x}Te_3$ demonstrates that the critical mechanism of the ferromagnetism can be described well with 3D-Heisenberg model. Our work may benefit for the practical applications of ferromagnetic TIs with opened surface band gap in spintronics and magnetoelectric devices.

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Zhen Zhang
Department of Electrical and Computer Engineering, Iowa State University

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