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Transition from n-type to p-type topological insulator thin films of Bi_2Te_3 JIN-FENG JIA, Key Lab for Atomic, Molecular and Nanoscience, Department of Physics, Tsinghua University, Beijing 100084, P. R. China, GUANG WANG, XIE-GANG ZHU, YAO-YI LI, TONG ZHANG, JING WEN, XI CHEN, KE HE, Institute of Physics, The Chinese Academy of Sciences, Beijing 100190, P. R. China, LI-LI WANG, XU-CUN MA, YI-YANG SUN, Department of Physics, Applied Physics, and Astronomy, Rensselaer Polytechnic Institute, Troy, New York 12180, USA, SHENG-BAI ZHANG, QI-KUN XUE — By using angle-resolved photoemission spectroscopy, we have investigated the electronic structure of the Bi_2Te_3 films on Si(111) prepared by molecular beam epitaxy. It is found that the Bi_2Te_3 films change from n-type to p-type topological insulator when the growth mode changes layer-by-layer to step-flow, for a given beam flux ratio of $Te_{2(4)}$/Bi. In situ scanning tunneling microscopy/spectroscopy (STM/STS) measurements reveal formation of different defects, i. e., Te_{Bi} and Bi_{Te} antisite defects, which are responsible for the n- and p-type conductivity transition. A mechanism for the transition is proposed based on the STM experiment and first-principles calculations. The work suggests a simple way to regulating the chemical potential and Dirac fermion density on the surface of a topological insulator without external doping.

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