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Influence of the pronounced degree of imperfection on the superconductivity, weak magnetism, and quantum transport

of crystallite structures with one or more nano-width multilayer interfaces of Bi1-xSbx (0.07 ≤ x ≤ 0.2) alloys

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Abstract

Magnetic, superconducting, and quantum oscillation phenomena in crystallite structures with nano-width multilayer interfaces of three-dimensional topological insulator Bi1-xSbx (0.07 ≤ *x* ≤ 0.2) have been studied. Samples with a high degree of imperfection have been prepared by the modified horizontal zone recrystallization method using the double seed technique. It has been found that the Dirac charge carriers in crystallite interfaces layers are much heavier than those in the bulk crystallites; therefore, the high imperfection at interfaces has a significant impact on carrier scattering and predetermines the manifestation of various anomalies of superconducting, magnetic, and quantum magneto-transport phenomena. Thus, the crystallite structures exhibit, simultaneously with superconductivity, ferromagnetic hysteresis loops, which also indicate the formation of a ferromagnetic underlying electronic structure. A number of crystallite structures with a rather high content of imperfections and two superconducting transitions exhibit dual superimposed ferromagnetic and superconducting loops, which denote the simultaneously coexistence of superconductivity and weak ferromagnetism in interfaces.