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Features of thermomagnetic transport due to the superconducting interfaces in inclination bicrystals of Bi and 3D topological insulator $Bi_{1-x}Sb_x$

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Abstract

We studied the thermomagnetic power S_{ii} (B) and Nernst–Ettingshausen effect S_{ii} (B) in inclination bicrystals of Bi and 3D topological insulator $Bi_{1-x}Sb_x$ ($0.04 < x \leq 0.12$) with superconducting nano-width interfaces ($T_c \leq 21$ K). High values of thermomagnetic effects in small disorientation angle (SDA) bicrystals far exceeding values in single-crystalline samples were found. It was established that S_{ii} (B) linearly increases in high fields without saturation and change the sign from negative in positive in bicrystals of 3D Dirac point forming ($x \sim 0.04$), specifying the signature of 3D topological semimetal. Contrarily, S_{ii} (B) in LDA bicrystals with $0.06 \leq x \leq 0.12$ undergoes saturation or increases smoothly, the Landau level index depends linearly on $1/B_n$, and extrapolate to -0.5 if $1/B_n \rightarrow 0$, what is typical for the 3D topological insulators. Two new quantum oscillation harmonics are reviled in high fields; they characterize different densities of electronic states and different levels of disorder at LDA and SDA interfaces.