Fermi-surface rearrangement in Bi bicrystals with twisting crystallite interfaces as the reason of superconductivity appearance

F. M. Muntyanu [1, 2], A. Gilewski [2], K. Nenkov [2, 3], A. J. Zaleski [4]

[1] *Institute of Electronic Engineering and Industrial Technologies, ASM, Chisinau, Moldova*
[2] *International Laboratory of High Magnetic Fields and Low Temperatures, Wroclaw, Poland*
[3] *Leibniz-Institut fur Festkorper und Werkstofforschung, Dresden, Germany*
[4] *Institute of Low Temperatures and Structural Research,PAS, Wroclaw, Poland*

Magnetization measurements prove that the magnetic properties of large-angle $\theta \geq 30°$ bismuth bicrystals with a crystallite interface (CI) of twisting types essentially differ from well-known results on single-crystalline specimens. Two superconducting phases with $T_c \approx 8.4$K and ≈ 4.3 K were observed at the CI of bicrystals while ordinary rhombohedral Bi is not a superconductor. We found that these phases have to do with the central part and the adjacent layers of the CI of bicrystals.

Our investigation of quantum oscillations of Hall resistance and magnetoresistance of Bi bicrystals with superconducting interface of twisting type revealed that the Fermi surface consisting at interface of bicrystals and bulk nonsuperconducting rhombohedral Bi are very similar. At the same time, clear differences are observed in the normal and superconducting behavior of the small and large crystallite disorientation angle interfaces. It is shown that the Fermi surface for electrons in small angle interfaces is less anisotropic and is much larger in volume than in bulk Bi. Also the considerable change of the shape, elongation, and volume of hole isoenergetic surface at large angle interfaces is revealed.