Critical currents in superconductor-ferromagnet heterosructures subjected to the injection of spin-polarized tunneling current

E.M. Rudenko, **D.A. Luzhbin**, Y.V. Kudryavtsev, I.V. Korotash, D.S. Dubina, and A.A. Krakovny

Institute for Metal Physics, National Academy of Sciences of Ukraine, Kyiv, Ukraine

Using state of the art technology we have produced the series of Co2CrAl-I-Pb heterostructures with the ferromagnetic Heusler alloy's spin-polarization ranged from 0 to 100% and the normal-state interface resistivities varied over the three orders of magnitude range. Extensive measurements of the current-voltage characteristics of the F/S junctions and the critical currents of the Pb films for different levels of the spin-polarized tunneling current injected from the ferromagnet into Pb were performed. Accumulation of the spin-polarized quasiparticles in the interface region significantly modifies the properties of the junction compared to that of N/S junction: (i) the normalized conductivity of a F/S junction depends on the value of the junction's differential conductivity in the normal state; (ii) the functional shape of IV curves of the F/S junctions is defined by the value of the interface resistivity; (iii) the critical current dependence in Pb film exhibits a plateau for low levels of the injection current and a monotonically decreasing part for the higher levels of injection with the plateau value depending on the normal-state interface resistivity. We propose the explanation of the observed dependences based on the "giant blocking of the tunneling current" phenomenon reported by us earlier, together with the general theoretical model of the proximised F/S contacts based on the Usadel equations formalism, where the suppression of the superconducting order parameter by the current injection is taken into account.