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Reentrant superconductivity in superconductor-ferromagnetic-alloy bilayers

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Abstract

Oscillating behavior of superconductivity in ultrathin bilayers of niobium and ferromagnetic alloy Cu41Ni59 has been observed. This phenomenon was most pronounced at a Nb layer thickness of about 7.3 nm: the superconducting transition temperature T c first sharply decreased with an increase in the ferromagnetic alloy thickness to complete suppression of superconductivity at the ferromagnetic alloy thickness d CuNi ≈ 4 nm. With a further increase in the thickness d CuNi, the superconductivity was restored at d CuNi ≥ 13 nm. This strongly nonmonotonic and reentrant behavior of superconductivity in Nb/Cu41Ni59 bilayers is attributed to implementation of a state in the ferromagnetic alloy that is similar to the quasi-one-dimensional Fulde-Ferrell-Larkin-Ovchinnikov state.