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Structural, Magnetic, and Superconducting Characterization of the CuNi/Nb Bilayers of the S/F Type Using Polarized Neutron Reflectometry and Complementary Techniques

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Abstract

© 2014, Springer Science+Business Media New York. Structural, magnetic, and superconducting properties of S/F bilayers Nb/Cu 40Ni 60 deposited on silicon substrate have been characterized using polarized neutron reflectometry and complementary techniques. The study allowed to determine real thicknesses of the S and F layers as well as the r.m.s. roughness of the S/F interfaces. The latter does not exceed 1 nm, showing the high quality of the S/F interface. Using SQUID and a mutual inductance setup, we determined the superconducting transition temperatures of the samples, which are in agreement with the literature data. Using of polarized neutron reflectometry (PNR) for the single S layer allowed to determine the screening length λ of the superconducting layer, λ = 120 nm. This value is higher than the London penetration depth for pure niobium which may indicate that the superconductor is in the dirty limit. PNR and SQUID studies of magnetic properties of the CuNi layer have shown the presence of ferromagnetism in all investigated samples.

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Keywords

Ferromagnets, Polarized neutron reflectometry, Proximity effects, Superconductors