Structure and Superconductivity of Nb/Pd(Mn) Multilayers

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We have grown Nb/Pd multilayers by sputtering and Nb(110)/Pd(111) superlattices by molecular beam epitaxy(MBE). Low-angle x-ray reflectance and high-angle x-ray diffraction at λ=1.54 Å were used to characterize their structure. In addition to the *ex situ* x-ray characterization, the MBE-grown samples were characterized *in situ* by reflection high energy electron diffraction. Measurements of their superconducting critical temperature (T_C) as a function of Pd layer thickness were used to study their superconducting behavior. The MBE samples were grown on Cu(111) buffer layers which were grown on Si(111) wafers. Thick films of pure Nb and Pd were used to measure the electron mean free paths and the T_C of the pure Nb. Although the structure of the sputter-deposited multilayers is good, the superconducting properties are strongly affected by residual contamination. In contrast, the MBE-grown films exhibit high residual resistivity ratios and T_C of the thick Nb film is not depressed from the bulk value as it is in the polycrystalline sputter-deposited films. The behavior of T_C as a function of Pd layer thickness is in agreement with the deGennes-Werthamer proximity effect theory, showing that Nb/Pd is a conventional proximity system.

This work was supported by the Office of Naval Research under contract N00014-92-J-1159.

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