Interlayer interaction in Mo/Si superlattices in a normal and superconducting states

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Abstract

The electronic interlayer interaction in superconducting Mo/Si multilayers was determined by measurements of the upper critical magnetic fields in the superconducting state, and of the magnetoconductivity in the normal state in magnetic fields parallel and perpendicular to the layer planes. These measurements allow the determination of the anisotropy parameter, γ, and of the effective thickness, L_{eff}, which characterize the interlayer interaction between the Mo layers across the Si layer. For Mo/Si series with a constant Si layer thickness, the L_{eff} oscillates as a function of the Mo layer thickness in correlation with the oscillations of the anisotropy parameter γ. The Josephson nature of the interlayer coupling in the superconducting state is confirmed by measurements of the magnetoconductivity on a sample set with a constant Mo layer thickness and variable Si layer thickness. The procedure of evaluating the effective metal layer thickness L_{eff} of the multilayers proposed in this work serves as a new quantitative method to determine the interlayer interaction in the layered systems.