Reentrant Superconductivity and Superconducting Critical Temperature Oscillations in F/S/F trilayers of $Cu_{41}Ni_{59}/Nb/Cu_{41}Ni_{59}$ Grown on Cobalt Oxide

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Abstract

Ferromagnet/Superconductor/Ferromagnet (F/S/F) trilayers constitute the core of a superconducting spin valve. The switching effect of the spin valve is based on interference phenomena occurring due to the proximity effect at the S/F interfaces. A remarkable effect is only expected if the core structure exhibits strong critical temperature oscillations, or most favorable, reentrant superconductivity, when the thickness of the ferromagnetic layer is increased. The core structure has to be grown on an antiferromagnetic oxide layer (or such layer to be placed on top) to pin by exchange bias the magnetization-orientation of one of the ferromagnetic layers. In the present paper we demonstrate that this is possible, keeping the superconducting behavior of the core structure undisturbed.

I. Introduction

In a superconducting spin valve [1,2], the critical temperature of a superconductor (S) sandwiched by two ferromagnets (F) depends on the relative orientation of the magnetization of the F-layers. To realize such device, fine tuning of material parameters and fabrication technology of F/S/F trilayers, representing the core structure, is necessary. Recently, we succeeded in the realization of a $Cu_{41}Ni_{59}/Nb/Cu_{41}Ni_{59}$ trilayer [3] exhibiting the unusual non-monotonic behavior of the transition temperature T_c, required for the functioning of a spin valve