Modification of exchange coupling in Fe/Nb/Fe/Pd layered structures using hydrogen

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3 nm Fe/d-Nb/3 nm Fe trilayers were prepared at room temperature using UHV magnetron sputtering. A capping layer of 5 nm Pd was used to catalyse hydrogen absorption and to avoid oxidation of the top Fe layer. The magnetic characterisation of the samples was performed using a vibrating sample magnetometer at 295 K. Calculations of the interlayer exchange coupling energy were carried out using ab-initio method with localized spin density and generalized gradient approximations of exchange-correlation potential. The bottom and top Fe layers were deposited in different deposition conditions to obtain relatively high difference in their coercive fields. The interlayer exchange coupling energy was determined from a shift of the minor hysteresis loop from the origin. Results showed clear antiferromagnetic (AFM) coupling maxima near 3, 6, 9, and 12 monolayers of Nb spacer. The above result was in good agreement with ab-initio calculations. Furthermore, the position of the AFM peaks and coupling energy values could be modified using hydrogen.