Optimization of spin-valve structure NiFe/Cu/NiFe/IrMn for planar hall effect based biochips

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Abstract: This paper deals with the planar Hall effect (PHE) of Ta(5)/NiFe(t_F)/Cu(1.2)/NiFe(t_p)/IrMn(15)/Ta(5) (nm) spin-valve structures. Experimental investigations are performed for 50 μm×50μm junctions with various thicknesses of free layer (t_F = 4, 8, 10, 12, 16, 26 nm) and pinned layer (t_p = 1, 2, 6, 8, 9, 12 nm). The results show that the thicker free layers, the higher PHE signal is observed. In addition, the thicker pinned layers lower PHE signal. The highest PHE sensitivity S of 196 μV/(kA/m) is obtained in the spin-valve configuration with t_F = 26 nm and t_p = 1 nm. The results are discussed in terms of the spin twist as well as to the coherent rotation of the magnetization in the individual ferromagnetic layers. This optimization is rather promising for the spintronic biochip developments.
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