Optimization of the multilayer structures for a high field-sensitivity biochip sensor based on the planar Hall effect

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Abstract: We have investigated the planar Hall effect (PHE) in three multilayer structures such as a bilayer, a spin-valve and a weak exchange bias coupling bilayer structure introduced a very thin Cu spacer layer between the antiferromagnetic and ferromagnetic layers. These thin films are Ta(3)/NiFe(10)/IrMn(10)/Ta(3) (nm), Ta(3)/NiFe(10)/Cu(1.2)/NiFe(2)/IrMn(10)/ Ta(3) (nm), and Ta(3)/NiFe(10)/Cu(0.2)/ IrMn(10)/Ta(3) (nm), respectively. The active layers in all three structures were kept constant. The field-sensitivity of the fabricated PHE sensors obtained for the respected structures are about 1.6 μV Oe-1 5 μV Oe-1, and 12 μV Oe-1 respectively. The results suggest that the sensor based on a weak exchange bias coupling structure has the highest field-sensitivity compared with the others. The proposed weak exchange bias coupling structure emphasizes for the development of the PHE sensor materials.

Author Keywords: Biomagnetics; High-field sensitivity; Planar Hall effect (PHE) sensor

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