Giant planar Hall effect in pulsed laser deposited permalloy films

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Abstract: Ni80Fe20 thin films with high orientation were grown on Si(100) using pulsed laser ablation. The anisotropic magnetoresistance (AMR) and the planar Hall measurements show a 2.5% resistance anisotropy and a 45% planar Hall voltage change for magnetic field sweep of 10 Oe. The planar Hall sensitivity dR/dH was found to be 900 Ω T-1 compared with a previously reported maximum of 340 Ω T-1 in the same system. Also these films are found to withstand repeated thermal cycling up to 110 °C and the Hall sensitivity remains constant within this temperature range. This combination of properties makes the system highly suitable for low magnetic field sensors, particularly in geomagnetic and biosensor applications. To elucidate this, we have demonstrated that these sensors are sensitive to Earth's magnetic field. These results are compared with the sputter deposited films which have a very low AMR and planar Hall voltage change as compared with the films grown by PLD. The possible reasons for these contrasting characteristics are also discussed.

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