ET05

Current-Induced Precession Mode in a Spin-Valve with an Oblique Exchange-Bias Pinning

Seo-Won Lee[1] and Kyung-Jin Lee[2]*

[1]Dept. Mater. Sci. And Eng., Korea University, Seoul 136-713, Korea

*Corresponding author: Kyung-Jin Lee, e-mail: kj_lee@korea.ac.kr

The current-induced steady-state precession of magnetization in a spin-valve structure has attracted a great interest because of its potential for the application in microwave oscillators. For the application, the exchange-bias pinning is essential to fix the magnetization direction of the polarizer. So far, most studies have used the exchange-bias along the magnetic easy axis of the nano-pillar. When the exchange-bias is tilted from the magnetic easy axis, three effects are expected in the current-induced magnetic excitation; the rotation of the principal precession axis, the shift of angular dependence of the spin-transfer torque azimuthally, and the tilting of the stray field exposed on the free layer. Here, we investigate the current-induced precession with varying the tilting angle of the exchange bias using the macrospin simulation with the Landau-Lifshitz-Gilbert -Slonczewski equation. Two spin-valve structures were studied. The sample 1 (PtMn(10)|Py(6)|Cu(6)|Py(8)|Cu (10), all in nm) shows a typical sinθ-like angular dependence of the spin-transfer torque (STT). The sample 2 (PtMn(10)|Co(6)|Cu(6)|Py(8)|Cu(10)) shows the wavy spin-transfer torque theoretically predicted [1] and experimentally confirmed [2]. The angular dependence of the spin-transfer torque was calculated the drift-diffusion model [3] (Fig. 1). It was found that the tilting angle of the exchange-bias provides the shift of boundaries in the phase diagram of the precession mode as a function of the current and the field. The sample 2 shows several unique precession modes in comparison with the sample 1 In the presentation, each precession mode will be discussed in detail.

This work is supported by the Korea Science and Engineering Foundation (KOSEF) through the Basic Research Program funded by the Ministry of Science and Technology (No. R01-2007-000-20281-0)

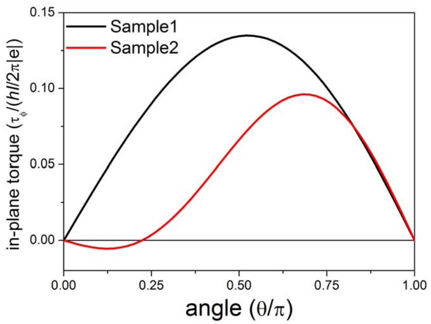

Fig. 1. Angular dependence of STT for sample 1 and 2.

[1] M. Gmitra and J. Barnas, Phys. Rev. Lett. 89, 223121 (2006).
[2] O. Boulle et al., Nature Phys. 3, 492 (2007).
[3] J. Barnas et al., Phys. Rev. B 72, 024426 (2005).

ET06

Anisotropy Magnetoresistance(AMR) Effect of New Macroscopic Ferrimagnet Co-TbN

H.N. Lee[1], Y.S. Cho[1], M.J. Park[1], J.U. Cho[2], Y.K. Kim[2], and T.W. Kim[1]*

[1]Department of Advanced Materials Engineering, Sejong University, Seoul, South Korea
[2]Department of Materials Science and Engineering, Korea University, Seoul, South Korea

*Corresponding author: T. W. Kim, e- mail: twkim@sejong.ac.kr

Macroscopic ferrimagnets are a new class of phase separated magnetic materials. In materials with two magnetic phases it is possible to have exchange coupling at the phase boundary when the two phases are in intimate contact. A macroscopic ferrimagnet Co-TbN, which consists of TbN particles in a Co matrix, showed the giant magnetoresistance (GMR) at room temperature. The GMR effect of the Co-TbN system was explained by scattering of spin polarized conduction electrons on antiparallel exchange coupled spins at the phase boundary between TbN particles and the Co matrix [1]. The recent study examined an AMR effect of macroscopic ferrimagnet Co-TbN which consists of two phase, HCP Co matrix and highly-ordered TbN precipitates. The macroscopic ferrimagnet exhibited a large AMR effect. The magnetoresistivity (δρ) and magnetoresistance (δρ/ρ) of Co-TbN thin film is about ~ 1×10^{-7} Ωcm and ~ 3 % at room temperature up to the field of 500Oe. The AMR effect of Co-TbN thin films showed a strong thickness dependence. As the thickness of thin films increased, the AMR effect decreased, which is different from those of normal AMR materials which is decreased with decreasing thickness.

[1] T. W. KIM , R. J. Gambino & T.R. McGuire , Journal Of Applied Physics, 89(1), 7299(2001).
[2] R. J. Gambino, R. R. Ruf, and N. A Bojarczuk, J.Appl. Phys. 75, 1871(1994).
[3] Taewan Kim and Jung Keun Oh, Journal of Magnetics 13(1), 11-18 (2008).