Abstract for an Invited Paper
for the MAR09 Meeting of
The American Physical Society

Spin-torque oscillators with tilted fixed layer magnetization

CHAOLIN ZHA, Department of Microelectronics and Applied Physics, Royal Institute of Technology, Sweden

One of the promising applications based on the spin transfer effect [1-3] is the Spin Torque Oscillator (STO) with signal generation at microwave frequencies related to ferromagnetic resonance. The STO may be thought of as a nanoscopic Yttrium Iron Garnet (YIG) oscillator with a similarly broad frequency range, but significant advantages such as easy on-chip integration, and current tunability instead of only field tunability. However, STOs still typically require a large, static, magnetic field for operation; removing the need for this field is currently an intensely researched topic. Three different STO designs have been attempted to address zero field operation: *i*) the perpendicularly polarized STO [4], *ii*) the wavy torque STO [5], and *iii*) the vortex STO [6]. Recently we proposed the Tilted Polarizer STO (TP-STO) having a fixed layer with an out-of-plane magnetic easy-axis tilted a finite angle away from the film normal [7]. In this talk, I will review our simulation work of the TP-STO and show its potential to generate large output signal in zero field. I will present detailed structural and magnetic characterization of single layer $L1_0$ (111) FePt with tilted magnetic anisotropy and show how we have fabricated FePt/Cu/NiFe pseudo spin valves with magnetoresistance values of about 0.5%, and as much as 5% if each interface is dusted with CoFe. Finally, I will present our preliminary work on observing actual microwave signal generation in nano-contact TP-STOs and discuss their potential for applications.

References

[1] J. C. Slonczewski, J. Magn. Magn. Mater. 159, 1 (1996).
[2] L. Berger, Phys. Rev. B 54, 9353 (1996).
[3] J. A. Katine,et al., Phys. Rev. Lett. 84, 3149 (2000).
[4] D. Houssameddine, et al, Nat. Mater. 6, 447 (2007).
[5] O. Boulle, et al., Nat. Phys. 3, 492 (2007).
[6] V. S. Pribiag, et al., Nat. Phys. 3, 498 (2007).
[7] Yan Zhou, et al, Appl. Phys. Lett. 92, 262508 (2008); idem, accepted, J. Appl. Phys., (2009).