Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Reduction of spin-torque switching currents by partially canceling the free layer demagnetization field LUQIAO LIU, TAKAHIRO MORIYAMA, DAN RALPH, ROBERT BUHRMAN, CORNELL UNIVERSITY TEAM — A small switching or excitation current is crucial for the successful application of spin torque (ST) in magnetic memory and on-chip oscillator devices. The required ST current for an in-plane-polarized nanomagnet is proportional to its effective field, within which the out-of-plane component (H_z) dominates. This large H_z, however, does not contribute to the thermal stability of the free layer. So it will be of great advantage if we can reduce H_z. Co/Ni multilayer structures have been shown to exhibit perpendicular anisotropy and we have precisely controlled the thickness of these multilayer components so that this crystalline anisotropy can be used to cancel the demagnetization field, reducing H_z to a value comparable to the in-plane geometry-dependent coercive field. In comparison to a control sample with a relatively higher H_z and the same magnetic volume, we find that the low H_z sample has much smaller ST reversal currents in both the quasi-state thermally activated and short pulse reversal regimes. The fact that the free layer magnetization lies in plane and the fixed layer(s) can be conventional magnetic material(s) makes it more tractable to deal with the dipole coupling between the free and reference layers, and should also facilitate the incorporation of this approach in high performance ST devices that utilize magnetic tunnel junctions.

Luqiao Liu

Date submitted: 20 Nov 2008 Electronic form version 1.4