Magnetoresistance and Spin Transfer Torque in Arrays of Co/Cu Multilayered Nanowires

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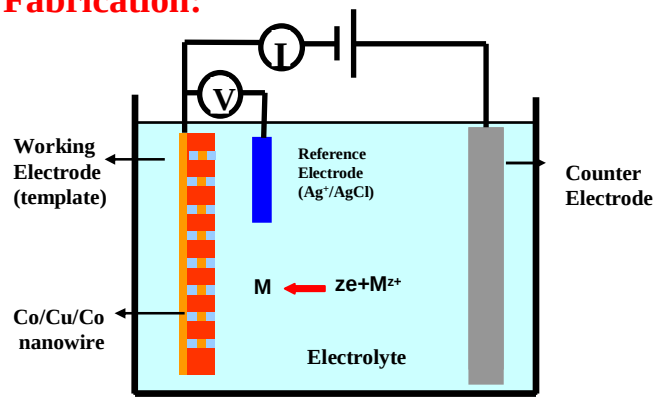
Motivation:

Co/Cu multilayered nanowires in Anodic Aluminum Oxide (AAO) template gained increasing attention. They have great potential for technological application, such as CPP-GMR sensor, magnetic random access memory (MRAM), and next generation recording heads.

Advantages:

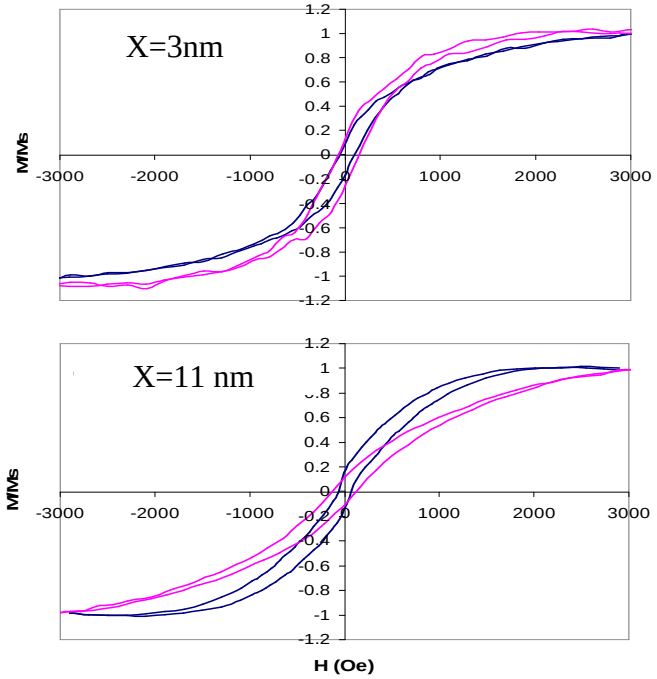
1. Adequate magnetoresistive ratio ΔR/R;
2. Small RC time constant;
3. Adequate heat dissipation;
4. Lower noise.

Fabrication:

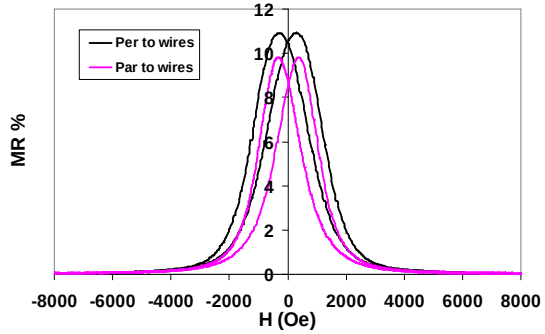


Co/Cu nanowires electrodeposition

Magnetic Properties:



MH loops of 300*[Co(27 nm)/Cu(X nm)] nanowires

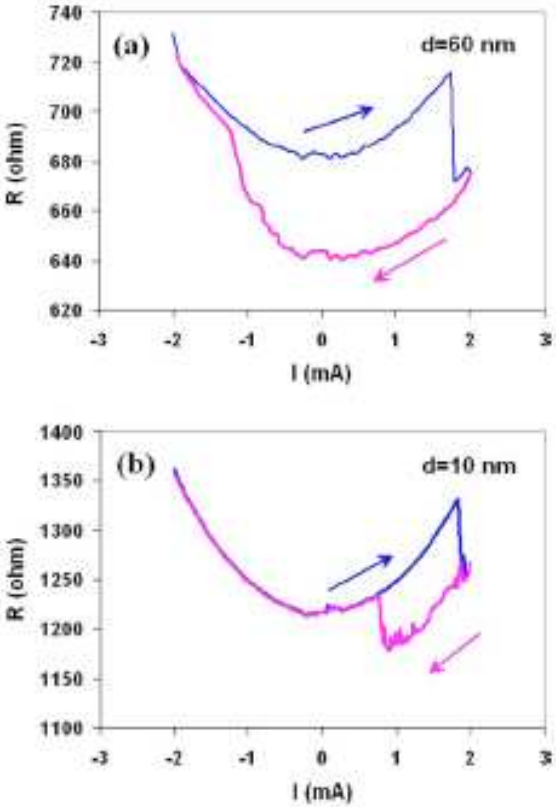


1) As the Cu thickness increased, the anisotropy switched from out of plane to in plane.

2) Magnetically isotropic nanowires had the highest MR.

3) MR=11% when Hper; MR=10% when Hpar at 300 K.

Spin Transfer Torque (STT):



STT measured in the 60 nm and 10 nm diameter Co/Cu multilayered nanowires

The current densities required to switch the Co layers from antiparallel to parallel and back (J^{AP-P}/J^{P-AP}) were 2.7 x 10^8/1.3 x 10^8 and 3.2 x 10^7/-1.6 x 10^7 A/cm^2 respectively for the 10- and 60-nm diameter nanowires.

Reference: X. Huang, L. Tan, H, Cho, and B. Stadler, Journal of Applied Physics 105, 1 (2009)

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