Magnetic Interfaces and Nanostructures
Room: Hall D - Session MI-ThP

Magnetic Interfaces and Nanostructures Poster Session

MI-ThP1 Fabrication of Permalloy Nanowire Structure to Realize a Magnetic Analog to a Coupled Pendulum, ***M.S. Seo**, S.U. Cho, C.W. Yang, Y.D. Park*, Seoul National University, Republic of Korea

We report on the fabrication of NiFe nanowires structures to demonstrate a magnetic analog to a coupled pendulum. Coupled high-frequency resonators have already been demonstrated in magnetic nanostructures.[1] Recently, an analog to a mechanical pendulum system has been applied to measure the mass of a domain wall in NiFe nanowires.[2] We have designed a NiFe nanowires structures akin to two semicircular arc segments, arranged with a mirror symmetry about the tangent, with a separation distance ≤ 100 nm. From symmetry arguments, the magnetostatic forces couple the domain walls formed at the apex of each semicircular segment. By varying the separation distances as well as driving current densities, the coupling strengths can also be modulated. The structures are patterned by e-beam lithographic techniques on a UHV sputter deposited NiFe. Each segment is probed electrically allowing for driving force as well as to detect current induced resonance effects on domain wall resistance for each segment. Along with experimental data at the extremes of coupling strengths, we will also compare the results with finite element analysis modeling.

[1] S. Kaka et al., Nature 437, 389 (2005); F.B. Mancoff et al., ibid 437, 393 (2005).

[2] E. Saitoh et al., Nature 432, 203 (2004).

MI-ThP2 Magnetic Dot Polarity Switching Via Current Generated Magnetic Fields, ***M.R Rao**, J.C Lusth, S. Burkett, Y.K Hong*, University of Alabama

This paper describes the manipulation of the magnetic alignment of nickel dots using a magnetic field generated by current flowing through an aluminum wire. This architecture has the potential to operate as a memory device offering low power dissipation, high integration density, and room temperature operation. The aluminum wire had dimensions of 250 nm in thickness, 10 µm in width, and 40 µm in length. The nickel dots were formed by electron beam lithography and had a thickness of 100 nm and diameter ranging from 200 nm to 500 nm. The dots were deposited in an array such that some dots lay on the wire and some dots lay nearby. A magnetic field was applied to the ferromagnetic dots by passing current through the aluminum wire. Switching of the dots magnetic polarity was observed using magnetic force microscopy (MFM). MFM cantilever phase and amplitude images were used to identify the reversal of the polarity of the dots. Contrast changes were detected upon reversing the current flow. The fabrication of this device concept is relatively simple. Microscale aluminum wires are patterned with conventional photolithographic techniques while a separate electron beam lithography step is used to pattern nickel dots at variable position across the wire. The nickel dot's magnetic field is oriented in a specific direction after passing electric current through the aluminum wire. On reversal of the current, the dot's magnetic field is oriented in the opposite direction. These directions can be treated as a logic '1' or logic '0'. The orientation of the magnetic dots remains even after switching off the current. This indicates potential operation as a memory device.

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