Magnetostrictive Fe-Ga/Cu Nanowires Array for Sensing Applied Pressure

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Nanowire Fabrication and Characterization

 $Fe_{100-x}Ga_x$ (10 $\leq x \leq 25$ atomic %) shows large magnetostriction (~400 ppm) and ductile mechanical properties. Multilayered structures (Fe-Ga/Cu) was used to reduce the dominance of shape anisotropy



Micromagnetic simulation



A multi domain vortex structure forms at remanence with no strain. The stray field from the NW segments under compression. magnitude of stray fields induced by changes in magnetic domain structure will directly influence the GMR resistance.

NSF, ECCS # 1540539

Experimental results

GMR sensor



Experimental results

- No resistance change was observed by Cu NW array sample.
- The coarse step (~ 1 μ m) causes 2 times larger GMR % value change (0.5 - 0.65%) than the value change (0.2 - 0.3%) caused by the fine step (~ 100 nm).
- Estimated values of sensor sensitivity are $1 \sim 4 \text{ m}\Omega/\text{kPa}$.

 $[GMR\% = ((R(H) - R(H_m)))$





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IEEE SENSORS JOURNAL, VOL. 17, NO. 7, APRIL 1, 2017









