NANO HIGHLIGHT
Nanomanufacturing Strategy and System Design for Nanoscale Patterned Magnetic Recording Medium

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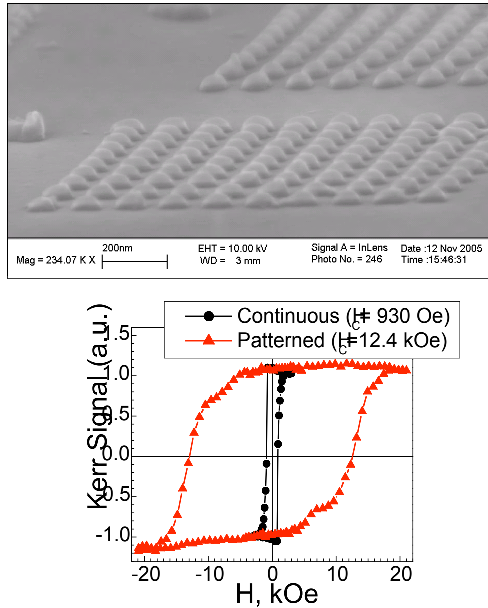

Figure 1: (top) Electron micrograph of a patterned medium test sample based on exchange coupled $(Co/Pd)_{10}$ multilayer stack; (bottom) magnetization curves of continuous and patterned multilayers.

Nanoscale Patterned Magnetic Recording Medium: Among the recent achievement of our NIRT team is a large area (1 x 1 cm^2) patterned medium prototypes fabricated using atom/ion-beam lithography (see Figure 1). High-anisotropy exchange-coupled (Co/Pd) magnetic multilayers developed by the team were used for patterning. The magnetization curves of the multilayer films measured before and after patterning (see Figure 1) show, *for the first time*, more than a 10x increase in the coercivity in ultra-high anisotropy magnetic multilayers due to the creation *of artificial barriers to domain wall motion*. In addition to serving as a probe of fundamental nanomagnetic concepts, these experiments demonstrate the potential of atom/ion beam lithography patterned medium fabrication and the suitability of the developed magnetic multilayers for ultra-high density patterned recording medium applications.

Ultra-Thin Atom/Ion Scattering Masks: We have demonstrated the feasibility of using ultra-thin objects as atom/ion beam scattering masks. Two micrographs shown in Figure 2 demonstrate a nearly perfect replica in silicon dioxide of a 20nm carbon nanotube. This result is highly non-trivial since the stopping range of the 30 keV helium atoms used to print the image is 0.4 μm, which is more than 200 times larger than the nanotube diameter at its center. This ratio is even larger at the edges. Preliminary modeling data indicate that indeed the intensity in the shadow region may drop to below 1 % of that in the areas with direct illumination. Thus, ultra-thin foils can serve as masks in atom beam lithography.

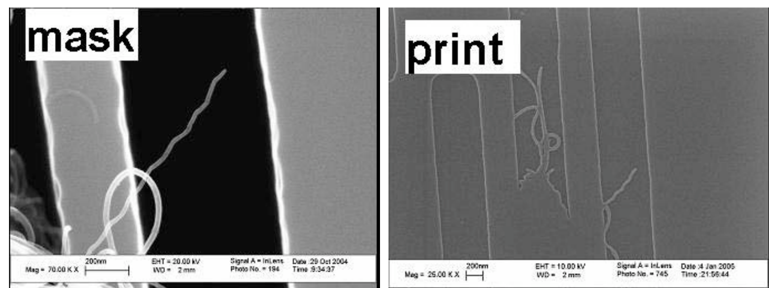

Figure 2. Electron micrographs of (top) 20nm carbon nanotube overlaid on top of a silicon stencil mask; (bottom) atom beam lithography print of a 20nm carbon nanotube in silicon dioxide.

References

[1] For further information about this project link to http://www.uh.edu/cns or e-mail to dlitvinov@uh.edu.