GOALI: Constricted Current CPP Magnetic Sensor Via Electroplating

Xiaobo Huang, Bethanie J. H. Stadler and Randall H. Victora

Electrical and Computer Engineering, University of Minnesota

Advantages of Constricted Current (CPP) Read Heads:

- Good choice for high density recording media
- High magnetoresistive ratio ΔR/R
- Good heat dissipation
- Sufficiently small R for small RC time constants

Motivation:

- In order to acquire adequate magnetoresistance ΔR/R in CPP geometries, A needs to be substantially reduced because R=ρL/A, (ρ = resistivity, L = length of the current path, and A = cross-sectional area),
- Electroplating is a good way to grow Co/Cu nanowires with sharp edges.
- Templates being researched for nanowire growth include self-assembled anodic alumina and e-beam defined holes in polymethylmethacrylate (PMMA).

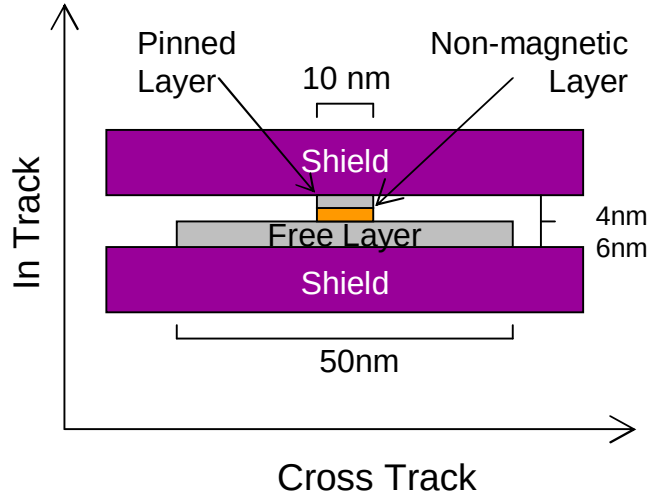


Figure 1. Ideal geometry of constricted current CPP read head

Observation:

- In order to get the smallest hole in PMMA, the trend between diameter and dose is being investigated (Fig 2).
- The spacing between the hole affects the diameter of holes.
- The smallest hole (Fig 3) - for 300nm spacing, dmin= 68nm
  - for 400nm spacing, dmin= 75nm
- AAO pores can be smaller (~10nm, but will not be ordered yet)

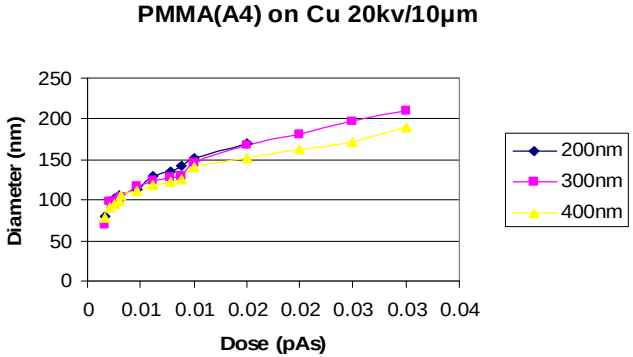


Figure 2. Trend between diameter and dose

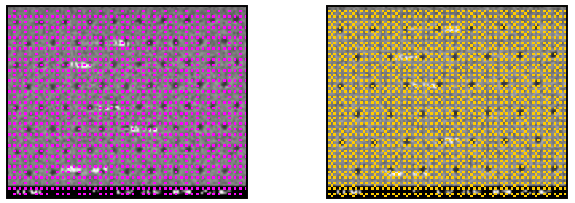
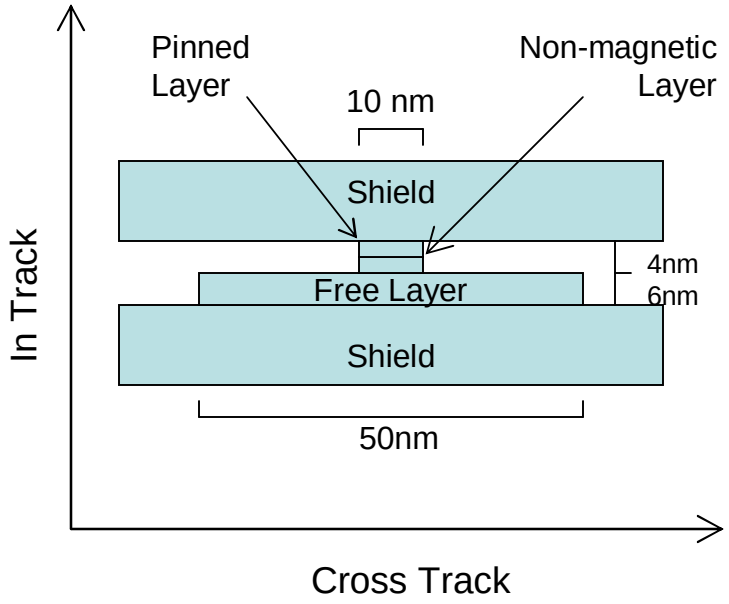


Figure 3. SEM images of PMMA, 300nm space (left); 400nm space (right)

Future work:

- Continue to decrease PPMA hole diameters
- Continue to increase the range of order in 10nm AAO.
- Grow nanowires and measure the magnetoresistance.


Pinned
Layer
Non-magnetic
Layer
10 nm
Shield
4nm
6nm
Free Layer
Shield
50nm
In Track
Cross Track