

GOAL: Constricted Current CPP Magnetic Sensor Via Electroplating

Bethanie J.H. Stadler (PI), Xiaobo Huang

Electrical & Computer Engineering, University of Minnesota

NNIN Facilities utilized: Characterization Facility & Nanofabrication Center

Advantages of Constricted Current (CPP) Read Heads:

- Sub-10nm size for high density recording media
- High magnetoresistive ratio $\Delta R/R$
- Good heat dissipation
- Sufficiently small R for small RC time constants

Motivation:

- In order to acquire adequate magnetoresistance $\Delta R/R$ in CPP geometries, area needs to be substantially reduced because $R = \rho L/A$, (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 and lower cost.
- Self-assembled anodic alumina provides small-diameter nanopores which can be templates for nanowire growth.

Observations:

- In order to get the smallest pores in AAO, Al foils were anodized at different concentration of H_2SO_4 . The results are shown in Fig 1. The smallest nanopores were achieved at 1.5 mol/l H_2SO_4 , 15 V anodization voltage and 0 °C anodization temperature.
- Nanowires with 300 layers of Co/Cu were successfully electroplated into the smallest nanopores.
- The MR of Co/Cu nanowires with 10 nm diameter was 8.73% at 300K, 10.81% at 200K and 11.43% at 150K. (Fig 2).

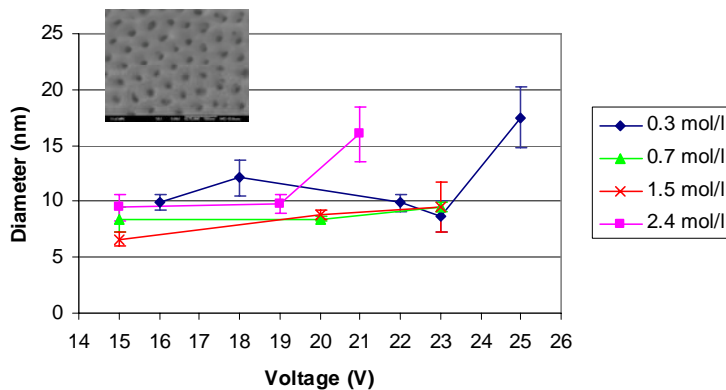


Figure 1. The diameter of nanopores changes with the H_2SO_4 concentration and anodizing voltage at 0 °C

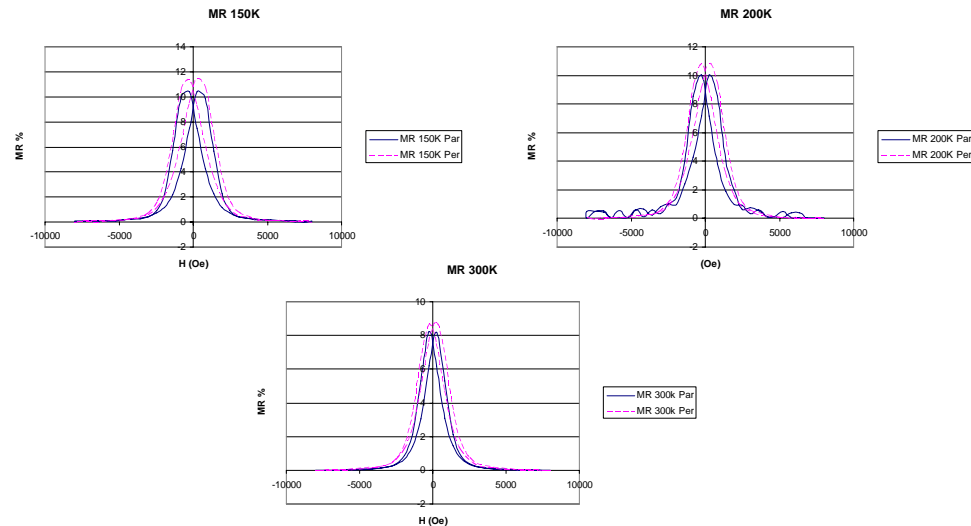


Figure 2. MR of Co/Cu nanowires at 150k, 200k and 300k

Future work:

- Decrease the number of the layers of Co/Cu and measure the MR.
- Adjust the thickness of Co and Cu to get the highest MR.