Characterization of surface roughness, stress and resistivity of Cu-Ta and Cu-Ru nanolaminates as a function of lamination frequency and thickness

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Introduction

- Current-perpendicular-to-the-plane (CPP) giant magnetoresistive (GMR) read heads are being studied intensively for the next generation of disk drives.
- In CPP-GMR structures, the top and bottom current-carrying leads need to be approximately 100 nm thick layers of Cu in order to minimize the potential drop across the leads.
- The interface roughness and large grains of the thick Cu bottom layer seed large grains in the ferromagnetic layers in the GMR stack, thereby degrading both the GMR ratio as well as the soft magnetic properties.
- We also studied the effect of lamination frequency on the stress.

Experimental Details

- [Cu/Ta]_N, N=1, 2, 4, 6, 8, 10, keeping the total thickness of Cu=150 nm and Ta=5nm. Conventional dc magnetron sputtering
- Sputtering Systems: Shamrock and Key
- Targets: Cu, Ta, Ru
- Deposition conditions (Shamrock)
  - Base pressure: $<5 \times 10^{-7}$ torr.
  - Power: Ta ~100 W DC; Cu ~450 W DC.
  - Pressure: 3 mTorr Ar.

Future Work

- Study microstructure and interface properties using transmission electron microscopy.
- Study effect of roughness on magnetic properties and GMR ratio.

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