Sputtered Cr/CoPt Films on Tape


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Abstract

Sputtered films for longitudinal tape media(1,2) are expected to yield higher areal densities than conventional granular or evaporated coatings, because of the greater film density achievable. Motivated by interest from MINT sponsors Hitachi-Maxell and Sony, we investigated Fe₈₀Pt₂₀, Co₈₀Pt₂₀, and Co₈₀Pt₅₀ alloys sputtered on PET and Aramid tape. After some preliminary work on the various alloys we focused on Co₈₀Pt₃₀ with a Cr underlayer because a) it yielded the best magnetic properties as-deposited, and b) it would be more practical for coating tape than Fe₅₀Pt₅₀ with its high Pt content. The Cr and CoPt thicknesses were optimized for coercivity and Mrt. Flash lamp annealing (for Fe₅₀Pt₅₀) and excimer laser pulse annealing (for Co₈₀Pt₃₀) were attempted in an effort to improve the magnetic and structural properties of the as-deposited films. The best coercivity achieved for Co₈₀Pt₃₀ was 2310 Oe.

Deposition Experiments

- Substrates
  - PET, Aramid
- Films sputtered
  - Fe₈₀Pt₃₀ (co-sputtered)
  - Co₉₀Pt₃₀ (co-sputtered)
- Co₈₀Pt₃₀
- Underlayers (for Co₈₀Pt₃₀)
  - Cr vs. Ru

Post-Deposition Annealing

- IR Flash Lamp Annealing of FePt at ORNL (courtesy G. Thompson and R. Ott)
- KrF pulsed laser annealing of Co₈₀Pt₃₀ at UA (courtesy J. Zhong and R.K. Pandey)
- Laser annealing experiment:
  - Exposed films to a single laser pulse in air
  - KrF excimer laser, 248 nm
  - Power density of 3.67x10⁶ W/cm²
  - Best results on unsupported tape (no heat from substrate): 2180 Oe to 2310 Oe with no degradation of Mrt.

Results and Discussion

- Magnetic properties of films from alloy targets were much better than co-sputtered films => higher rates, denser films.
- CoPt with Cr underlayer yielded best as-deposited properties.
- Ru underlayers appeared to yield higher Mrt than equivalent Cr underlayers -- needs further investigation.
- Flash annealing of FePt showed some ordering, but coercivities were still low.
- Pulsed laser annealing of films yielded some improvement in coercivity with almost no degradation of Mrt in the best case. Most results indicated damage, however.

Conclusions

We have optimized the magnetic and seed layer thickness for Cr/CoPt sputtered on tape for media applications. Novel post-deposition lamp and laser annealing schemes were carried out. Our best results as-deposited were over 2300 Oe for a laser-annealed CoPt film with a Cr underlayer. Future experiments will focus on the investigation of additional or alternative seed layer materials and the optimization of deposition and laser annealing parameters. We also plan to investigate the effect of patterned organic underlayers (dendrimers).

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