Fabrication of large uniaxial anisotropy films for anisotropy graded media


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Motivation

In Hard Disk Drive (HDD) information stored in the magnetization of several magnetic grains. Making small grains with good thermal stability and writability is very important to realize ultra high density recording.

Recently, new concepts such as ECC media[1], Hard/Soft stacked media[2] Exchange spring media[3] and Anisotropy graded media[4] have been reported to reduce the switching field with maintaining good thermal stability.

In these concepts, the grains are composed of magnetically hard and soft parts. For hard part, a very high anisotropy energy, $K_u$, of order $10^7$ erg/cm$^2$ is required to make full use of these concepts.

In this work, we have focused on fabricating magnetically hard thin films with high $K_u$ for anisotropy graded media. We report the results of seed layer optimization through structural analysis, and magnetic layer thickness dependence of structural and magnetic properties.

Results and discussion

1. Seed layer effect

Ru and CoPt with Ta pre-seed layer showed strong hcp (0002) orientation. The peak intensity of specimens without Ta pre-seed layer is much smaller than those with Ta layer.

2. Magnetic layer thickness dependence

Intensity of CoPt decreased as thickness decreased. Integrated intensity of CoPt is proportional to magnetic layer thickness. hcp structure of CoPt is formed in the initial atomic layers.

Sample preparation

Deposition DC magnetron sputtering
Sputtering system AJA system, Shannrock
Substrate 2" Si substrate (thickness : 300 μm)
Film structure Co$_8$Pt$_{20}$ (5 nm)/Seed layer/Si sub

With Ta pre-seed layer

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<th>Pre-seed layer</th>
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Conclusion

- Ta pre-seed layer is important for CoPt (0002)/Ru(0002) layer to make easy axis normal to the film plane.
- Large $K_u$ of order $10^7$ was obtained with Ta pre-seed layers.
- Squareness of CoPt film increased as film thickness decreased.
- $M_s$ of 5 nm film showed small value resulting in the small calculated value of $K_u$.

Future plans

1. Continuous anisotropy graded media

2. Discrete anisotropy graded media

References


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