

Temperature dependence of magnetic property in CoSiB-based thin-film structures

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1. Introduction

Since perpendicular magnetic anisotropy was first observed, it has attracted interest in relation to high-density magnetic recording media and has been studied as a possible candidate mechanism for use in high density spin transfer torque magnetic random access memory [1,2]. High-density magnetic recording media are types of next-generation memory technology. However, in order this high-density, next-generation memory devices require large coercivity (H_c), high magnetic anisotropy (K_u) and low saturation magnetization (M_s). Large H_c is particularly required in order to overcome the demagnetizing fields in high density magnetic recording media [3-6].

Thin films composed of both ferromagnetic metals and nonmagnetic materials have been studied with a view to enhancing K_u . Furthermore, amorphous materials have been introduced as substitutes for transition metals. As a result, thin films composed of the above mentioned amorphous materials and non magnetic materials have been investigated in the search for relatively high K_u and low M_s . In general, amorphous materials have been found to exhibit low M_s and modest K_u [7-12].

2. Experiment

The chamber's base pressure was up to 2.0×10^{-7} Torr, and the working pressure was 2×10^{-3} Torr. All films were uniformed in size, $1.4 \text{ cm} \times 1.4 \text{ cm}$, and were deposited by ultra high-vacuum system at room temperature. In order to study about thermal effect, all samples were annealed by rapid thermal annealing system between $300^\circ\text{C} \sim 500^\circ\text{C}$. The magnetic properties of all thin-films were measured by a vibrating sample magnetometer.

3. Result and discussion

The H_c and M_s depend on temperature and the shape of hysteresis loop shows bow-tie shape at high temperature. According to change the values of H_c and M_s , K_u exhibits various values with increasing temperature. The details will be shown in conference.

4. Conclusion

In this research, we studied the thermal effects on the magnetic properties of the CoSiB/Pd multilayers with perpendicular magnetic anisotropy and the temperature dependence. In a future study, a more diverse and systematic study will be performed to confirm this correlation between physical description of the magnetic properties and the temperatures.

5. References

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