The Interface Anisotropy of CoFeB/MgO using Amorphous FeZr Buffer Layer

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1. Introduction

STT-MRAM (Spin transfer torque-magnetoresistive random access memory)[1] has considered as an outstanding candidate for the next generation memory device. Higher anisotropy constant k and low saturation magnetization Ms are required for the perpendicular magnetic layers to satisfy the high thermal stability and low current density for current induced magnetic switching. The perpendicular magnetic anisotropy have been reported in Fe-Pt alloy[2] ordered by L10, Co/Pd multi-layer[3] and CoFeB-MgO[4].

2. Experiments

We report the perpendicular magnetic anisotropy of CoFeB based with MgO using amorphous paramagnetic FeZr buffer layer. Samples are deposited on SiO_2 substrate by RF magnetron-sputtering machine at room temperature. The structures are SiO_2/FeZr(2)/CoFeB(tCoFeB:0.5-2)/MgO(1-2.5)/Ta(1) (in nm) and annealing for 1 hour at 400℃ in high vacuum chamber without external magnetic field. Ta capping layer protect from the oxidation of samples. We fabricated the sample with a various thickness of CoFeB and measured the hall resistivity using the Van der pauw method. The magnetization was measured by VSM (vibrating sample magnetometer).

3. Results

Figure 1 shows Hall effect of perpendicular magnetic anisotropy of CoFeB after annealing and coercivity field of one is about 80Oe. During the annealing treatment, Boron diffused out of CoFeB and absorbed in amorphous FeZr layer. After anealing process, the lattice of CoFe became BCC lattice structure along with crystal structure of upper MgO. Therefore, the interface anisotropy is formed between CoFeB and MgO layers in rather thin thickness. The crystallized temperature of FeZr layer is much higher than the annealing temperature for MgO curing and CoFeB crystalization. FeZr layer buffers crystallization propagation and work as morphology stopping layer.

4. Conclusion

In summary, we observed the perpendicular magnetic anisotropy in CoFe/MgO using the FeZr buffer layer. We obtain a high anisotropic constant K with a various conditions. Variation of annealing temperature, thickness of CoFeB and FeZr have been practiced. This method can be an excellent candiate for perpendicular anisotropy MTJ with low critical current density.

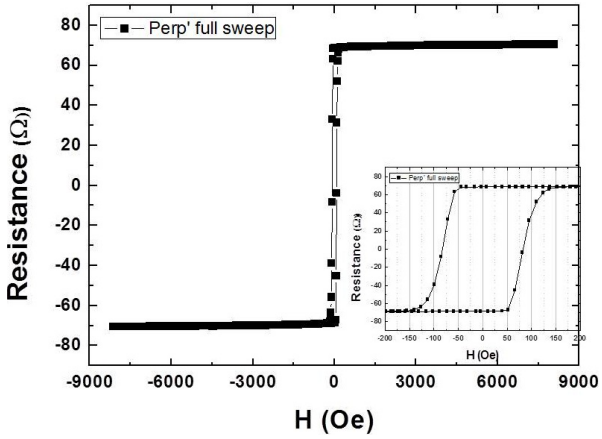

Fig. 1. Hall effect measurement of CoFeB. The curve shows that CoFeB layer has the perpendicular magnetic anisotropy

References

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