酸化物磁性層による 90 度磁気結合を用いた疑似反強磁性層の作成 II

Quasi antiferromagnetic layer by 90 degree magnetic coupling through magnetic oxide layer II

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It has been theoretically reported that spin transfer torques (STT) in antiferromagnetic (AFM) materials should be obtained[1] and the supporting experimental evidences have been reported[2,3]. However, in AFM, the magnetic oscillation by STT has never been observed because of the strong exchange coupling between adjacent atoms. Therefore, we try to fabricate the quasi AFM layer by using the 90 deg magnetic coupling through a magnetic oxide layer, which has stripe domains with alternately antiparallel magnetization to each other.

The films were sputtered on thermal oxidized Si wafer as shown below.

SiO_2/Ta5/Ru2/IrMn5/$Co_{90}Fe_{10}$2(A)/Fe-O1/$Co_{90}Fe_{10}$2(B)/Cu3/$Co_{90}Fe_{10}$2.5(C)/Cu1/Ta5 (unit: nm)

Fe-O was fabricated by the natural oxidation process. After depositing Fe, the oxygen gas was introduced into the vacuum chamber and the exposure was 50 kL. The deposited films were annealed in a field of 4.1 kOe at 270 ℃ for 1 h. *MH* curves, *RH* curves and FMR were measured.

Figure 1 shows *MH* curve and *RH* curve when a field is applied in the perpendicular direction (90 deg) to the annealing field (0 deg). The *MH* curve indicates that the magnetization of (B) layer symmetrically couples with that of (A) layer with an angle of 90 deg or -90 deg. The schematic image of magnetization of (A) ~ (C) layers are shown in Fig. 2.

Figure 3 shows the result of FMR measurements. Only one kind of FMR absorption can be observed below 20 GHz, which corresponds to (C) layer with free magnetization. It is found that the FMR of (B) layer has the frequency over 20 GHz as expected.

In conclusion, we have successfully fabricated quasi AFM layer. In order to observe the FMR of (B) layer, we will prepare the measurement system for higher frequency and control the magnetic domain structure in (B) layer to change the FMR frequency.

[1] A. S. Núñez *et al.*, Phys. Rev. B **73**, 214426 (2006). [2] Z. Wei *et al.*, Phys. Rev. Lett. **98**, 116603 (2007).
[3] T. Moriyama *et al.*, J. Appl. Phys. **106**, 162406 (2015).

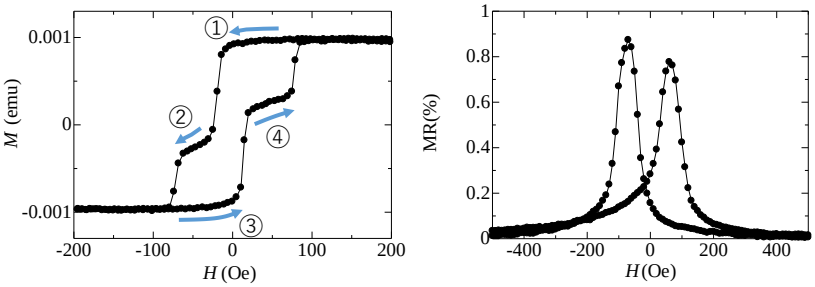

Fig. 1 *MH* curve and *RH* curve in 90 deg

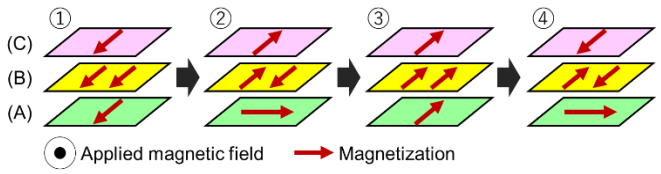

Fig. 2 Magnetization of three magnetic layers when measuring the 90 deg *MH* curve

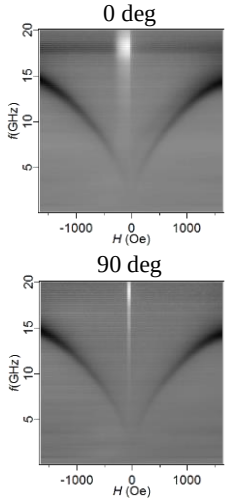

Fig. 3 Field-frequency transmission map