各種磁性層を挿入した YIG/Pt のスピンホール磁気抵抗効果

Spin Hall magnetoresistance of YIG / Pt with magnetic layer inserted into the interface

1.九州大シス情,2.JST PRESTO 新村拓未 [1],中田記矢 [1],李厚霖 [1],黒川雄一郎 [1],湯浅裕美 [1,2]

Takumi Niimura[1], Fumiya Nakata[1], Li Houlin[1], Yuichiro Kurokawa[1]and Hiromi Yuasa[1,2]

1. Kyushu Univ., 2.JST,PRESTO

[Introduction] We have investigated the spin Seebeck voltage in the system of YIG / magnetic layer / Pt (5 nm) and reported that these voltages are large more than YIG / Pt (5 nm) [1]. This is probably because the spin mixing conductance was improved by inserting the magnetic layer. In this research, by measuring the spin Hall magnetoresistance (SMR), we discuss the improvement of the interface state by inserting the magnetic layer. In addition, by discussing the relationship with the spin Seebeck voltage, we also investigate the relations between interface state and the electromotive force.

[Experimental method] YIG (50 nm) was sputtered on a thermally oxidized Si substrate and annealed in air at 750 ° C for 1 hour. A magnetic layer (t nm) / Pt (5 nm) was sputtered onto the above substrate. For the magnetic layer, Fe, $Fe_{50}Co_{50}$, $Co_{90}Fe_{10}$, $Ni_{80}Fe_{20}$ and Cr were used, and the film thickness t was varied as 0.3, 0.6, and 1. For the measurement method, the SMR was measured by a four-probe measurement method with an external magnetic field applied at -1500 Oe to 1500 Oe. The spin Seebeck coefficient was calculated with a temperature gradient applied by one set of Peltier elements and the temperature difference between the upper surface and the lower surface of the sample as ΔT.

[Result] Fig. 1 shows the results of SMR at YIG / NiFe 0.6 nm / Pt 5 nm as an. The SMR curve shows a typical behavior which the resistance R decreases as saturating the magnetization by increasing a magnetic field. Here, various magnetic layers are inserted with different thickness, and the electric resistance change ΔR is shown in Fig. 2. The largest value was obtained when 0.6 nm of Fe was inserted in the interface between YIG and Pt. This correlates with the result of the spin Seebeck electromotive force [1], indicating that the electromotive force increases owing to the interface improvement. In the presentation, we discuss the material dependence of SMR with compared to the Spin Seebeck coefficient

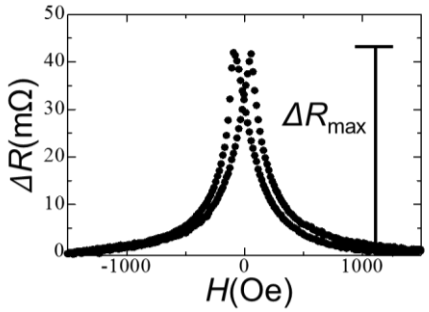

Fig1: Example of SMR

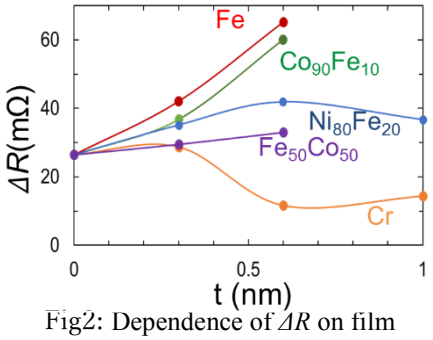

Fig2: Dependence of ΔR on film thickness of various magnetic layers

This research was conducted with the support of PRESTO-JST (JPMJPR 15 R 8), Tateishi Science and Technology Promotion Foundation, Spin-RNJ, Grant-in-Aid for Scientific Research (16 K 13617)

[1] R. Nakamura *et al.*: 第 64 回応用物理学会春季学術講演会　講演予稿集 14p-P10-76