

YIG/TaW スピンゼーベック素子における Ru 挿入層の役割

Role of Ru insertion layer at the interface of YIG/TaW for Spin Seebeck effect

九大シス情¹, JST PRESTO² ○李厚霖¹, 新村拓未¹, 中田記矢¹, 黒川雄一郎¹,
湯浅裕美^{1,2}

¹Kyushu Univ. ²JST PRESTO ○Houlin Li¹, Takumi Niimura¹, Fumiya Nakata¹,

Yuichiro Kurokawa¹, Hiromi Yuasa^{1,2}

E-mail: lihoulin@mag.ed.kyushu-u.ac.jp

Introduction

Using the Spin Seebeck effect and the inverse Spin Hall effect generate voltage in a uniform structure, which has a potential of thermoelectric generation. However, the voltage is too small to be utilized. Increasing of Spin Seebeck coefficient is necessary to obtain the better thermoelectric conversion efficiency. We have reported that inserting Ru into the interface of $\text{Y}_3\text{Fe}_5\text{O}_{12}$ (YIG) and TaW film can increase Spin Seebeck coefficient [1][2]. The origin is supposed to be restraining the TaW oxidation, but we have to add another explanation since Ru insertion improved Spin Seebeck coefficient in YIG/Pt system, too. One possibility is the RuO formation at the interface with YIG, which can modify the conductance matching between YIG and metallic layer. In this report, to compare the influence of inserting Ru and RuO on the Spin Seebeck coefficient, we fabricated YIG/RuO/Ru/TaW samples, where the upper Ru is not oxidized not to oxidize TaW.

Experimental method

The sample structure is YIG/RuO(0.2nm)/Ru(0.3nm)/TaW(4.5nm) as show in Fig.1. We used YIG (35mm \times 5mm \times 1mm) sintered body as substrate Ru and TaW were sputtered by DC magnetron sputtering. RuO was fabricated by introducing oxygen into a chamber after sputtering Ru film. The oxygen exposure was changed from 0 to 30 kL. Measurement systems were shown in Ref. [1][2].

Results and discussion

Figure 2 shows the Spin Seebeck coefficient for the samples as shown in inset. The Spin Seebeck coefficient decreased as the increase of the oxygen exposure, which indicates that Spin Seebeck improvement is not explained by the conductance matching. The role of Ru insertion is considered as the simple oxidation barrier.

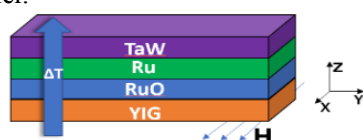


Fig.1 Space experimental method

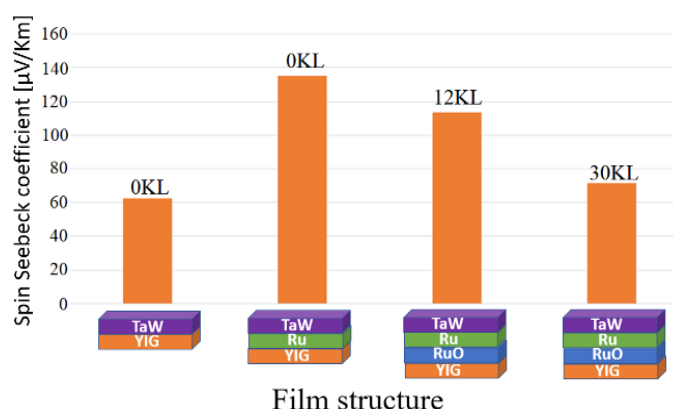


Fig.2 Spin Seebeck coefficient with different structure

[1] Nakata et al.: The 64th JSAP spring meeting 14p-P10-78 (2017).

[2] H. Yuasa, F. Nakata, R. Nakamura and Y. Kurokawa, J. Phys. D Appl. Phys. 51 (2018) 134002.