

YIG/Pt-Rh におけるスピンゼーベック効果の観測

Observation of Spin Seebeck Effect in YIG/Pt-Rh

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[Introduction]

Thermoelectric power generated from spin Seebeck effect (SSE) can be enhanced by using the heavy metal with high spin Hall conductivity. In this study, to fabricate binary alloy with high spin Hall conductivity, we use Rh and investigate SSE using YIG/Pt-Rh film, where Rh has an fcc crystal structure similar to Pt, and their lattice mismatch is only less than 2.7%.

[Experiment]

Figure 1 shows sample structure images. YIG (50 nm)/ Pt_xRh_{100-x} (3 nm) bilayer films were deposited by using sputtering method. The Pt composition x was varied from 0 to 100. The YIG layer was annealed at 1023 K in air to obtain garnet crystalline structure. The spin Seebeck voltage V_{SSE} was measured under various temperature difference ΔT while a in-plane magnetic field H is swept from -0.3 T to $+0.3$ T. The ΔT was applied on the sample by using a pair of Peltier devices. We also measured resistance of the samples with probes distance 10 mm.

[Result]

Figure 2 shows the dependences of $\frac{V_{SSE}}{\Delta T}$ and R on the Rh composition x . While the $\frac{V_{SSE}}{\Delta T}$ shows the maximum value around $x=60$ in similar to SSE using the other binary alloys [1][2], the resistance shows a simple increase with increasing x unlike most binary alloys. To obtain the power from SSE devices, it is needed to realize not only $\frac{V_{SSE}}{\Delta T}$ high but also R . However, in general, there is a positive correlation between $\frac{V_{SSE}}{\Delta T}$ and R . The mismatch between trends of $\frac{V_{SSE}}{\Delta T}$ and R in YIG/ Pt-Rh suggests that we get the composition with the high $\frac{V_{SSE}}{\Delta T}$ and the low resistance simultaneously.

[Acknowledgement] This study was supported by KAKENHI (No. JP23K22827, JP22KK0056, JP24H00030, JP24H02235, and JP24H02235), the Center for Spintronics Research Network (Osaka), and the X-NICS (No. JJP011438).

[Reference]

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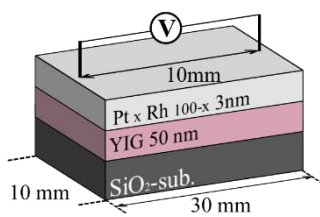
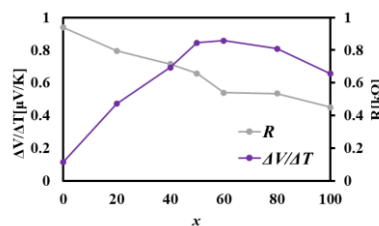


Fig. 1 Sample structure

Fig. 2 Resistance and $\frac{V_{SSE}}{\Delta T}$ as functions of Rh composition