

アモルファスフェリ磁性体 Gd-Fe を用いた熱スピン発電

Spin thermoelectric power generation using amorphous ferrimagnetic Gd-Fe alloy

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[Introduction]

Thermoelectric conversion devices attractively studied as one of method of the conversion waste heat to electric energy. Recently, thermoelectric conversion methods using spin current, which are called spin Seebeck effect (SSE) and anomalous Nernst effect (ANE), have been reported. In the previous study, we reported SSE in yttrium iron garnet. In this study, we investigated ANE in amorphous ferrimagnetic Gd-Fe alloy films which have low thermal conductivity.

[Experiment]

Gd-Fe alloy films with various thickness (t) was deposited on thermally oxidized Si substrate by DC magnetron sputtering. To investigate the ANE, the Gd-Fe films were sandwiched using two Peltier devices. Temperature gradient was applied in perpendicular to the samples. The ANE was observed by measuring the voltage in Gd-Fe films under various magnetic field and temperature gradient.

[Result and consideration]

Figure 1 shows ANE voltage (V) in Gd-Fe film with thickness $t = 100$ nm as a function of magnetic field (H) under various temperature gradient (ΔT). As shown in Fig. 1, the hysteresis loop of ANE voltage in Gd-Fe alloy film was clearly observed, and saturation ANE voltage is increased with increasing ΔT . We found that the saturation ANE voltage increases with increasing thickness, and achieved $15.4 \mu\text{V}$ at $t = 250$ nm under $\Delta T = 12$ K.

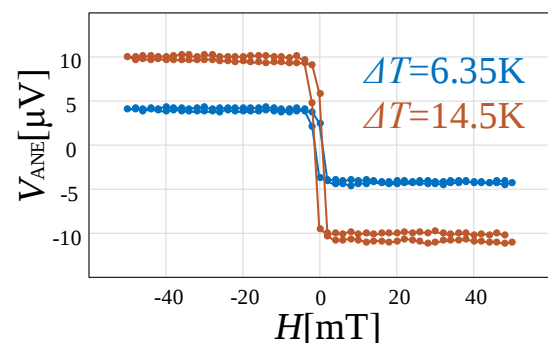


Fig. 1 ANE voltage (V) in Gd-Fe film with thickness $t = 100$ nm as a function of magnetic field (H) under various temperature gradient (ΔT).

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