フェリ磁性体における磁化補償温度の水素誘起変調

Hydrogen-induced modulation of magnetization compensation temperature in ferrimagnets

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Rare earth(RE)-transition metal (TM) alloy ferrimagnets are attracted attention because they exhibit fast magnetization dynamics near the magnetization or angular momentum compensation temperature. On the other hand, bulk RE-TM alloys have long been studied as hydrogen storage materials [1]. The reason of this is that the RE elements are easily hydride. Therefore, it is expected that the magnetic properties of the RE-TM thin films are also modulated by hydrogeneration and they are applied to new magnetic devices driven by hydrogen. In this study, we have investigated the hydrogen-induced modulation of magnetic properties in RE-Co (RE=Gd, Tb) alloy thin films.

Pt(2 nm)/RE-Co(5)/Pt(2) films were deposited on a Si substrate using sputtering and fabricated into Hall bar structure. The devices were exposed to pure H_2 gas with the pressure of 5.0×10^4 Pa for 1h at room temperature. Figure 1 shows the results of measurements of the anomalous Hall effect (AHE) at 300 K for the $Gd_{48}Co_{52}$ device before and after H_2 exposure. The sign reversal of AHE, as well as the change in AHE magnitude, can be observed after the H_2 exposure. We have investigated temperature dependence of AHE and found that the magnetic compensation temperature of the $Gd_{48}Co_{52}$ thin film largely decreases along with the hydrogeneration, resulting in the sign reversal of AHE. Since the observed H_2 effect in the single Gd film has been negligibly small, the modulation of Gd-Co coupling caused by the hydrogeneration is expected to be the origin of the present results.

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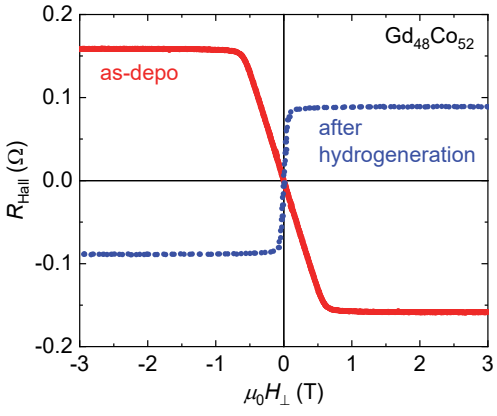

Figure 1: Results of the AHE measurement before and after H_2 exposure in $Gd_{48}Co_{52}$ Hall bar device.

[1] K. Buschow *et al.*, *J. Appl. Phys.* **49**, 1480 (1978).