Fe_3Si 膜における異常ネルンスト効果

Anomalous Nernst effect in Fe_3Si film

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The anomalous Nernst effect (ANE), one of the thermomagnetic effects studied for long time, has been regarded as a promising next-generation energy harvesting technology owing to its scalability [1]. However, since the ANE power is too short for practical use, it is necessary to enhance ANE. For example, it was reported that ANE was improved by doping Ga into Fe due to the topological band structure [2]. In this report, ANE of Fe_3Si was investigated because the silicide has good compatibility with Si devices and its high efficiency of spin pumping [3].

The sample structure and measurement system are shown in Fig. 1. Fe_3Si 50nm was fabricated on SiO_2 substrate by co-sputtering and annealed in vacuum at 973K for 30 minutes. The crystalline structure of Fe_3Si was confirmed by XRD

Figure 2 shows the ANE voltage induced by magnetic field at different ΔT. Figure 3 shows ANE voltage as a function of ΔT for Fe_3Si 50nm and Fe 50nm. The anomalous Nernst coefficient was 12.4[nV/K] in Fe_3Si 50nm, which was about 34.5 times larger than 0.359[nV/K] in Fe 50nm.

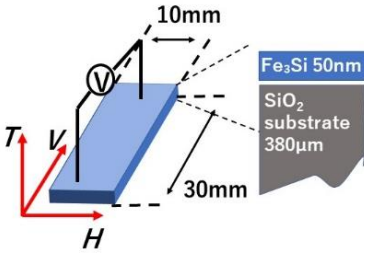

Fig. 1 Schematic of ANE measurement system.

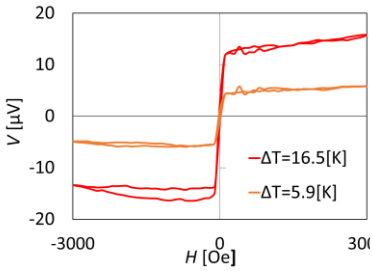

Fig.2 ANE voltage for Fe_3Si 50nm.

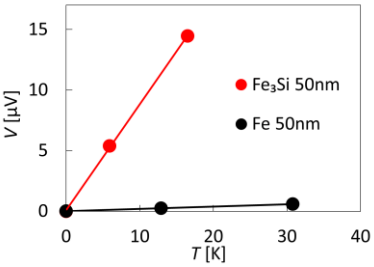

Fig. 3 ANE voltage dependence on temperature gradient ΔT.

References
[1] M. Mizuguchi et al., APEX **5** 093002 (2012).
[2] A. Sakai et al., Nature **581** 53 (2020).
[3] Y. Ando et al., Phys. Rev. B **88** 140406(R) (2013).