鉄基焼結体合金における異常ネルンスト効果

Anomalous Nernst Effect in Iron- based sintered alloys

NEC[1]，○大森康智[1]，岩崎悠真[1]，澤田亮人[1]，黒島貞則[1]，石田正彦[1]，桐原明宏[1]

NEC Corp.[1], ◦Yasutomo Omori[1], Yuma Iwasaki[1], Ryohto Sawada[1], Sadanori Kuroshima[1], Masahiko Ishida[1], Akihiro Kirihara[1]

E-mail: omori_yasu@nec.com

Recently, the Anomalous Nernst Effect (ANE) is attractive as thermoelectric conversion. An important characteristic of ANE is the transverse geometry of the thermoelectric conversion, which enables us to produce the thermoelectric module more simply and cheaper. However, the conversion efficiency of the ANE is still too small for applications compared to the traditional Seebeck Effect. It is necessary to explore more efficient and practical materials. In this research, we have studied the electromotive force of the ANE in iron based sintered alloys. Iron is one of the most common and cheap metal on the Earth. Also the sintering technique has advantage on mass production and processability.

Firstly, we prepared Fe-Al alloys with different Al concentration by using Spark Plasma Sintering (SPS) technique. The electromotive force of the ANE S_{yx} has dramatically enhanced with increasing the ratio of Al and showed the maximum S_{yx}=4 μV/K when the ratio of Al is 25%. It is comparable for other researches on bulk single crystalline Fe_3Al [1]. Then we prepared $Fe_{75}X_{25}$ (X=B, Si, Ga) alloys for the comparison between the effects of different doping elements. They show similar enhancement of the ANE, but the effects were smaller than that of Al. Furthermore, to find more efficient ANE materials, we have tried to enhance the electromotive force of $Fe_{75}Al_{25}$ by adding other elements. We have successfully obtained S_{yx} = 5.6 μV/K in Fe-Al-Tb ternary alloy.

[1] A. Sakai, et al., “Iron-based binary ferromagnets for transverse thermoelectric conversion”, Nature volume 581, 53–57(2020).