28p-A7-1

強磁性合金薄膜における異常ネルンスト効果と異常ホール効果の相関

Relation between anomalous Nernst and Hall effects in ferromagnetic alloy films

東北大金研 [1]，JST-さきがけ [2]　○水口 将輝 [1,2]，長谷川 浩太 [1]，内田 健一 [1]，
齊藤 英治 [1]，高梨 弘毅 [1]

Tohoku Univ. [1], JST-PRESTO [2],　°Masaki Mizuguchi[1,2], Kota Hasegawa[1], Ken-ichi Uchida[1],
Eiji Saitoh[1], Koki Takanashi[1]

E-mail: mizuguchi@imr.tohoku.ac.jp

【Introduction】The correlation between spin and charge in electronic transport has been energetically studied in a scheme of spintronics research. Recently, the coupling between heat current, spin current and charge current is also attracting much attention, and this newly established filed is called “spin-caloritronics”. Recently, we directly measured anomalous Nernst effect (ANE) in epitaxial $L1_0$-ordered FePt thin films with perpendicular magnetization, and succeeded in estimating the effect quantitatively[1]. In this study, we measured ANE and also anomalous Hall effect (AHE) of ferromagnetic alloy films with several magnetic anisotropy energies (K_u), and investigated the relation between two effects systematically.

【Experiment】Ferromagnetic alloy thin films were deposited on MgO(001) single crystal substrates. The sample size was 3×10 mm^2, and K_u was changed in a wide range. K_u values were estimated by measurements of magnetizations using a superconducting quantum interference device magnetometer. One side of the sample edge was heated by a contacted strain gauge and a temperature gradient was yielded in the film along the long side of a rectangle for ANE measurements. The voltage between the short sides was measured with a magnetic field perpendicular to the film. For AHE measurements, an electric current was introduced in samples instead of a temperature gradient. Both effects were measured at the temperature between 4 and 300 K.

【Results and Discussion】Nernst coefficient (S_{xy}) of FePt films with two K_u values (3×10^7 and 7×10^6 erg/cc) were measured. S_{xy} monotonously increased with temperature. This behavior was similar to that of Seebeck coefficient (S_{xx}). Hall conductivity also monotonously increased with temperature. It is known that ANE and AHE are linked by Mott relation, and we investigated whether this relation is applicable or not for various thin films by comparing both effects. Microscopic origin of ANE will be also discussed in detail in comparison with AHE.

This research was partly supported by JST, PRESTO and a Grant-in-Aid for Scientific Research (24656002) from Japan Society for the Promotion of Science.

[1] M. Mizuguchi, S. Ohata, K. Uchida, E. Saitoh and K. Takanashi, Appl. Phys. Express **5** (2012) 093002.