

Anomalous Nernst effect in Co/Au/Fe trilayer thin films

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The Nernst effect is one of the thermomagnetic effects, and the additional phenomenon that occurs when the target material has a spontaneous magnetization, such as a ferromagnetic material, is called the anomalous Nernst effect (ANE). The ANE has several features that are not found in the Seebeck effect, which is widely used as a thermoelectric device, and is expected to be applied to high-performance thermoelectric devices.^[1,2] The development of materials that exhibit large ANE and the establishment of a control method for the ANE are essential for the application to thermoelectric devices. As a preliminary step to obtain a large ANE, we sandwiched a nonmagnetic layer between two ferromagnetic layers and conducted experiments to confirm how the thickness of the nonmagnetic layer in magnetically coupled trilayer films affects the ANE.

Co/Au/Fe trilayer thin films were grown on MgO (001) substrates by magnetron sputtering. The thickness of the Fe and Co layers was fixed at 10 nm, and the thickness of the Au layer was varied. The ANE was measured using the physical properties measurement system (PPMS) by applying a thermal gradient to the sample in the in-plane direction and an external magnetic field of -50,000 Oe to 50,000 Oe in the direction perpendicular to the sample and measuring the electromotive force across the thermal gradient in the plane.

As shown in Fig. 1, the transverse Seebeck coefficient (S_{xy}) substantially changed depending on the Au film thickness (t_{Au}). A maximum peak in the S_{xy} was observed when the Au layer thickness was around 2.0 nm. Details of the Au layer thickness dependence will be discussed.

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Reference

- [1] M. Mizuguchi *et al.*, Sci. Tech. Adv. Mater, **20**, 262 (2019).
- [2] M. Mizuguchi, Oyo Buturi, **90**, 78 (2021).

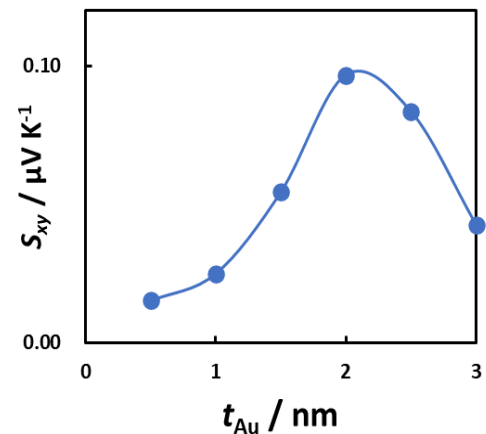


Fig. 1 Dependence of the transverse seebeck coefficient on the Au layer thickness in Co/Au/Fe trilayer thin films. Curve is shown as guides for the eyes.