

## Mapping in-plane magnetization in Co thin film using laser-induced anomalous Nernst effect

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The anomalous Nernst effect (ANE) generates the electromotive force in the direction of a cross-product of magnetization and temperature gradient. The ANE can be studied using not only homogeneous temperature gradients formed by heaters but also localized temperature gradients generated by laser irradiations. Because a large localized temperature gradient can be created via the laser irradiation method, we can obtain information on the in-plane magnetization component in the transverse direction of a magnetic wire as previously reported [1, 2]. However, a complete determination of the in-plane magnetization vector requires simultaneously detecting the ANE voltages in two orthogonal directions in the film plane.

Here, we report a vector imaging of the in-plane magnetization using the laser-induced ANE. We fabricated a magnetic thin film with the composition of Ru(5 nm)/Co(10 nm) on a sapphire (0001) substrate at room temperature by DC sputtering. The thin film was processed to Hall devices with a cross size of 0.4 mm × 0.4 mm by standard lithography techniques. We modulated the intensity of green laser beams at a frequency of 84 kHz; then, the laser beams were focused on the surface of the device with a diameter of 6 μm by an objective lens. Here, the average laser power was set at 57 mW. After magnetic domain walls were formed by an external magnetic field, we simultaneously measured ANE voltages along the two orthogonal directions while scanning the device inside a 100 μm × 100 μm area. As a result, we succeeded in visualizing the magnetization directions in the magnetic domains. In the presentation, we would like to show more experimental details and discuss the results.

### References

- [1] M. Weiler et al., Phys. Rev. Lett. **108**, 106602 (2012).
- [2] R. Iguchi et al., Sci. Rep. **9**, 18443 (2019).