Four-terminal sensing of the anomalous Nernst effect induced by laser illuminations

東工大理[1], 京大化研[2] ○(B)望月 颯一郎[1], (M2)大林 尚文[1], (M2)杉浦 達[2], 塩田 陽一[2], 森山 貴広[2], 小野 輝男[2], 佐藤 琢哉[1], 山田 貴大[1]

Tokyo Tech[1], ICR, Kyoto Univ.[2], ○Soichiro Mochizuki[1], Takafumi Obayashi[1], Itaru Sugiura[2], Yoichi Shiota[2], Takahiro Moriyama[2], Teruo Ono[2], Takuya Satoh[1], and Kihiro T. Yamada[1]

E-mail: mochizuki.s.ag@m.titech.ac.jp

Thermo-spin phenomena have been usually investigated using homogeneous thermal gradients by heaters [1]. On the other hand, when a magnetic material is heated by a focused laser beam, we can read local magnetic information resulting from the laser-induced thermo-spin effects [2].

Here, we report four-terminal sensing of laser-induced electrical voltages with the future aim of visualizing the magnetization vector of a magnetic thin film. For this study, we employed a Co (2 nm)/Pt (3 nm) multilayer made by dc sputtering on a thermally oxidized Si substrate at room temperature. By standard photolithography techniques, we processed the magnetic multilayer to a Hall device, both of which length and width are 0.4 mm. When a continuous-wave laser beam with a central wavelength of 808 nm was illuminated to the center of the Hall cross with a power density of ~21 kW/cm^2, longitudinal V_L and transverse V_W electrical voltages were measured with sweeping an external magnetic field along the length direction. We see a clear hysteresis for the V_L but not for the V_W. When the magnetic field rotates by 90°, the trend is reversed. The electrical voltages generate in the direction perpendicular both to the magnetization and laser propagation direction. This indicates that the electrical voltages predominantly result from the anomalous Nernst effect caused by the laser absorptions.

[1] K. Uchida *et al.*, J. Phys. Condens. Matter **26**, 343202 (2014).
[2] M. Weiler *et al.*, Phys. Rev. Lett. **108**, 106602 (2012).