

## Strain induced reversible sign change of the anomalous Hall effect in transition metal multilayers

阪大産研<sup>1</sup>, 阪大 CSRN<sup>2</sup>, 阪大 OTRI<sup>3</sup>, JST PRESTO<sup>4</sup>, 東北大 SRIS<sup>5</sup>

○森田 利明<sup>1</sup>, 小山 知弘<sup>1,2,3,4</sup>, 千葉 大地<sup>1,2,3,5</sup>

SANKEN, Osaka Univ.<sup>1</sup>, CSRN, Osaka Univ.<sup>2</sup>, OTRI, Osaka Univ.<sup>3</sup>,

PRESTO, JST<sup>4</sup>, SRIS, Tohoku Univ.<sup>5</sup>

○Toshiaki Morita<sup>1</sup>, Tomohiro Koyama<sup>1,2,3,4</sup>, and Daichi Chiba<sup>1,2,3,5</sup>

E-mail: tmorita11@sanken.osaka-u.ac.jp

The anomalous Hall effect (AHE) is a fundamental physics related to spin-dependent transport. In certain materials, the sign of the AHE can change depending on the temperature, the composition and the layer structure[1-3]. Recently, flexible spintronics utilizing the inverse magnetostriction effect has attracted attention[4]. The magnetostriction effect is a well-known phenomenon that combines strain and magnetism, but the modulation of magnetism by strain is still not fully understood. In this study, we observed strain induced reversible sign change of the AHE in transition metal multilayered films.

We deposited a few types of multilayers on flexible substrates by magnetron sputtering. Hall measurement was conducted without (w/o) and with (w/) application of a uniaxial strain in various temperatures. The small tensile jig was used to apply a strain. The results of Hall measurement for [Co/Pd]<sub>n</sub> multilayer are shown in Figure 1. Red and blue plots represent the results w/o and w/ strain, respectively. In w/o strain, the sign of the AHE is positive; Hall resistance is positive under positive magnetic field. In contrast, in w/ strain, the sign of the AHE reverses to negative. When the strain is removed, the sign of the AHE returns to positive (dashed orange plot). The same results were observed in other multilayers. We will discuss the origin of the results with additional data.

The authors thank S. Ota for technical support. This work is supported by Program for Leading Graduate School: “Interactive Materials Science Cadet Program”, JSPS KAKENHI (Grant No. 24KJ1613 and 23H00183), JST A-Step (Grant No. JPMJTR233A), JST CREST (Grant No. JPMJCR20C6), MEXT X-NICS, and the Spintronics Research Network of Japan.

- [1] Z.B. Guo *et al.*, *Phys. Rev. B* **86**, 104433 (2012). [2] V. Keskin *et al.*, *Appl. Phys. Lett.* **102**, 022416 (2013). [3] T. Golod *et al.*, *Phys. Rev. B* **87**, 104407 (2013). [4] S. Ota *et al.*, *Nat. Electron.* **1**, 124 (2018).

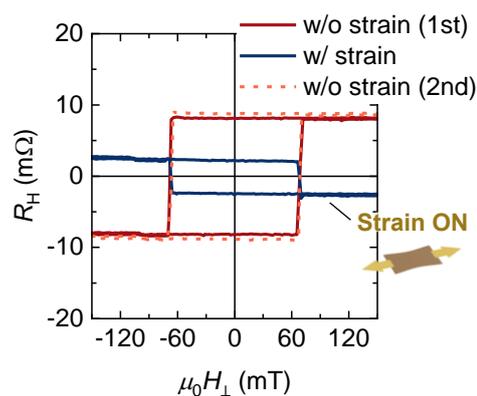


Figure 1: The results of Hall measurement. Blue and red plots represent the result w/o and w/ strain, respectively.