Pt/NiO/Co 構造におけるスピン軌道トルク

Spin-Orbit Torque in Pt/NiO/Co Structure

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Recently, in the ferromagnet (FM)/ heavy-metal (HM) structure, enhancement of the spin current transmittance at the interface by inserting an antiferromagnet (AFM) insulator between the FM and HM layers has been reported. NiO layer was often used as an AFM-insulator [1,2]. Improvement of the spin current transmittance is promising approach to reduce the current density for spin-orbit torque (SOT) magnetization switching. However, the effect of the AFM-insulator insertion on the SOT is still unclear. In this study, we investigate how the SOT is modulated by inserting a NiO layer in the widely used Pt/Co bilayer structure.

We deposited a Pt/NiO/Co multilayer by magnetron sputtering on thermally oxidized Si substrate at room temperature and patterned it into Hall bar structure. The Pt/Co film without NiO layer was also prepared as a reference. To evaluate the SOT, the harmonic Hall measurement was performed [Fig. 1(a)]. Unexpectedly, the damping-like (DL) SOT efficiency of our Pt/NiO/Co structure is smaller than that of the Pt/Co reference, as shown in Fig. 1(b). This result is not consistent with the previous report in which DL torque increases with the inserting NiO [3]. One possible reason for this difference is that NiO layer was formed by sputtering Ni target in O_2 atmosphere in the previous study, whereas the NiO target was used in our case. This may indicate that the sputtering condition for the AFM layer plays an important role in determining the spin current transmittance.

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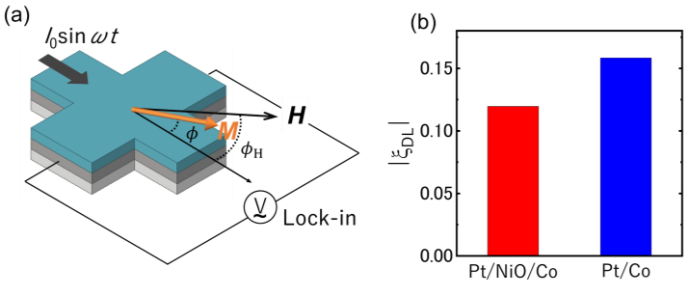

Figure 1: (a) Schematic illustration of the harmonic Hall measurement. (b) DL SOT efficiency of the Pt/NiO/Co and Pt/Co.

[1] H. Wang. *et al., Phys. Rev. Lett.* **113**, 097202 (2014). [2] W. Lin. *et al., Phys. Rev. Lett.* **116**, 186601 (2016). [3] L. Zhu. *Et al., Phys. Rev. Lett.* **126**, 107204 (2021).