強磁性体/銅/酸化物積層薄膜における軌道トルク効率の決定

Determination of orbital torque efficiency in ferromagnet/Cu/Oxide thin films

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The utilization of orbital angular momentum (OAM) provides a promising path for low-power-consumption spin manipulation. Recent studies show that an interaction between Cu and oxygen at an interface/surface such as Cu/Al_2O_3 leads to strong OAM polarization through the orbital Rashba effect, giving rise to a non-trivial torque (orbital torque, OT), 10-100 times more efficient than the conventional spin torque by the spin conversion [1,2]. Nevertheless, we still encounter plenty of issues to be addressed for further spintronic applications because of unconventional features of the OT.

We studied the OT for CoFe/Cu/OX (OX=MgO, SiO_2, TiO_2) ultrathin films. All the samples are prepared by the electron beam evaporation technique and photo-lithography. We measured the OT using the spin torque ferromagnetic resonance (ST-FMR) technique and found sizeable OT for all films (Fig. 1). Nonetheless, the magnitude of the OT varies depending on the capped oxide layer, and maximum OT appears for the SiO_2 capped films. Considering pronounced OAM polarization at the Cu/OX interfaces, we speculate that the different Cu-oxygen interaction depending on the capped layer provides a critical role in determining the OT efficiency. Further information will be given during the meeting.

[1] J. Kim *et al*., Phys. Rev. B, 103, L020407 (2021).

[2] D. Go *et al*., Phys. Rev. B, 103, L121113 (2021).

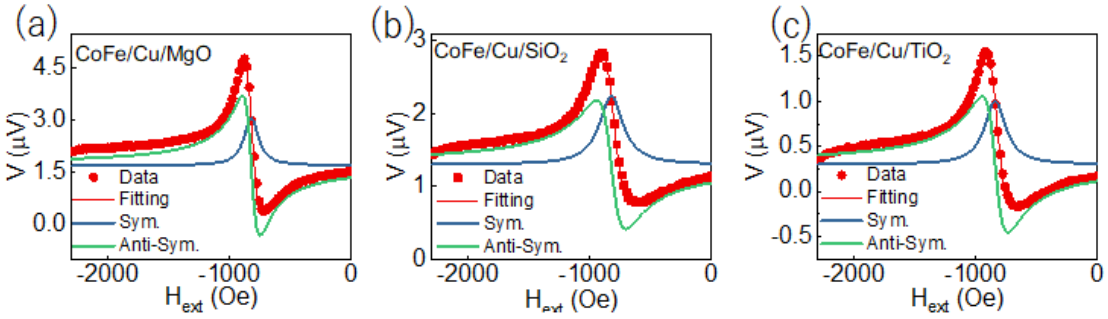

Fig. 1 Typical ST-FMR spectra for (a) CoFe/Cu/MgO, (b) CoFe/Cu/SiO_2, (c) CoFe/Cu/TiO_2.