Increased orbital magnetic moment and perpendicular magnetic anisotropies at the Fe/LiF interface

東大物性研[1]，産総研新原理[2]，KEK 物構研[3]，東大 TSQS[4]

○坂本 祥哉[1]，野崎 隆行[2]，湯浅 新治[2]，雨宮 健太[3]，三輪 真嗣[1,4]

ISSP, Univ. of Tokyo[1], AIST[2], IMSS, KEK[3], TSQS, Univ. of Tokyo[4]

○Shoya Sakamoto[1], Takayuki Nozaki[2], Shinji Yuasa[2], Kenta Amemiya[3], Shinji Miwa[1,4]

E-mail: shoya.sakamoto@issp.u-tokyo.ac.jp

The Fe/MgO interface is essential in spintronics as it shows giant tunneling magnetoresistance (TMR) and strong perpendicular magnetic anisotropy (PMA). A recent study [1] demonstrated that the insertion of an ultra-thin LiF layer between the Fe and MgO layers enhances PMA significantly while maintaining TMR. To reveal the origin of the enhancement, in the present study, we perform x-ray magnetic circular dichroism (XMCD) measurements on Fe/LiF/MgO multilayers.

The Fe/LiF/MgO multilayers were grown on single-crystalline MgO(001) substrates by molecular beam epitaxy [Fig. 1(a)]. XMCD measurements were performed at the beamline BL-16A in the Photon Factory. The magnetic fields of 5 T were applied parallel to incident x-rays, and the surface normal direction were either parallel to the incident x rays or tilted by 70 degrees. The obtained anisotropy of the orbital magnetic moment relative to the spin magnetic moment is plotted in Fig. 1(b) together with the coercive fields. We find that the LiF insertion increases the orbital magnetic moment anisotropy and thus the PMA energy. We attribute the strengthened orbital magnetic moment anisotropy to improved interface quality or a reinforced electron localization and orbital polarization at the Fe/LiF interface [2].

This work was partly supported by JSPS KAKENHI (22H00290, 22H04964, 22K18320), Spintronics Research Network of Japan (Spin-RNJ), JST-Mirai Program (JPMJMI20A1), MEXT Initiative to Establish Next-generation Novel Integrated Circuits Centers (X-NICS) (JPJ011438), and JPNP16007, commissioned by the New Energy and Industrial Technology Development Organization (NEDO), Japan.

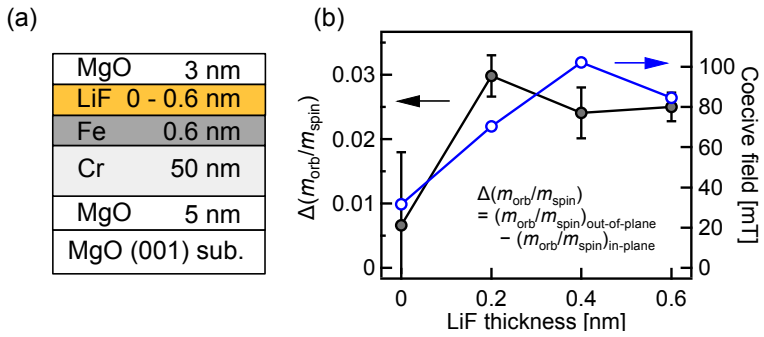

Fig. 1. (a) Sample structure. (b) Anisotropy of the ratio of orbital magnetic moment to the spin magnetic moment in comparison with the coercive fields.

[1] T. Nozaki *et al*., NPG Asia Mater. **14**, 5 (2022). [2] S. Sakamoto *et al*., Phys. Rev. B **106**, 174410 (2022)