Control of magnon damping in ultrathin Co by introducing nonmagnetic buffer layers

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Low-magnon damping in ferromagnetic (FM) metals have been studied to achieve long-distance magnon transportation and strong coupling with photon in them [1,2]. We realized the significant reduction of magnon damping in 1 nm-thick ultrathin Co by inserting Ta buffer beneath the ultrathin Co [2], which can expand possibilities in material choices for realizing strong magnon-photon coupling. One of the possible mechanisms to realize the reduction of the magnon damping in ultrathin Co is reduction of the in-plane magnetic anisotropy (IMA) field of Co by insertion of Ta [3]. To study the correlation between magnon damping and IMA field in metallic bilayers, we focus on the other nonmagnets, Ti and Al, because Ti reduces IMA field in Co like Ta and, in contrast, Al shows small change of IMA field in Co [4].

We prepared 2 nm-thick Co on Ti (sample A), Al (sample B) buffer layers and SiO_2 substrate (sample C) by electron beam deposition, and measured ferromagnetic resonance (FMR) of these samples, where a DC magnetic field was applied along the in-plane direction. Figure 2 shows the comparison of FMR spectra of sample A (red), sample B (blue) and sample C (black). The linewidth of the FMR spectrum of sample A is much narrower than that of sample C. On the other hands, the linewidth of the FMR spectrum of sample B is a little narrower than that of sample C, as expected from the difference of the IMA field by Ti and Al. These results corroborate that these nonmagnetic buffer layers reduce IMA and suppress the magnon damping in the Co film. A more detailed discussion will be given in the presentation.

[1] M. Schoen *et al*., Nat. Phys. **12**, 839-842 (2016). [2] S. Yoshii *et al*., Sci. Rep. **10**, 15764 (2020). [3] R. Arias and D. L. Mills Phys. Rev. B **60**, 7395 (1999). [4] A. J. Lee *et al*., Phys. Rev. Let. **124**, 257202 (2020).

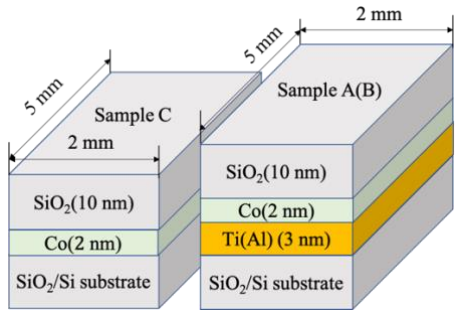

Fig. 1 Sample structures

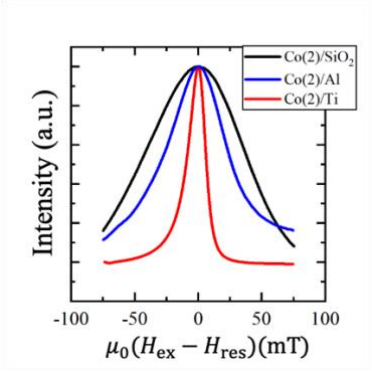

Fig. 2 Comparison of FMR spectra of samples A, B and C