人工反強磁性体における表面弾性波の巨大な非相反伝導

Large nonreciprocity of surface acoustic waves in a synthetic antiferromagnet

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Nonreciprocity of surface acoustic waves (SAW) in a ferromagnetic (FM) thin film is gaining much attention in recent years. In addition to the nonreciprocity originating from helicity mismatch between SAW and spin waves, highly nonreciprocal spin wave dispersion in a dipole-coupled FM bilayer with nonmagnetic spacer (~5 nm) makes it possible to realize a large amplitude nonreciprocity of SAW with a value larger than 90% [1,2]. In the system, dipole-interaction between stray fields and the dynamic magnetization induces the nonreciprocity of spin wave [3], causing the nonreciprocity of SAW via magnetoelastic and magneto-rotation coupling [2]. The nonreciprocity of SAW in a synthetic antiferromagnet, however, is yet to be reported experimentally, although a large nonreciprocity of SAW in a wide frequency range is predicted theoretically [4].

We fabricated a CoFeB bilayer with an ultrathin Ru spacer (< 1 nm) on a 128°Y-cut $LiNbO_3$ substrate. CoFeB layers are antiferromagnetically coupled via RKKY interaction. By measuring the SAW transmittance while sweeping an external magnetic field, we observed a large nonreciprocity of SAW with higher than 90%. Moreover, we found that the nonreciprocity in this structure is strongly dependent on the spacer Ru layer thickness, implying that not only the interlayer dipolar coupling but also the interlayer exchange coupling play an important role in the large amplitude nonreciprocity.

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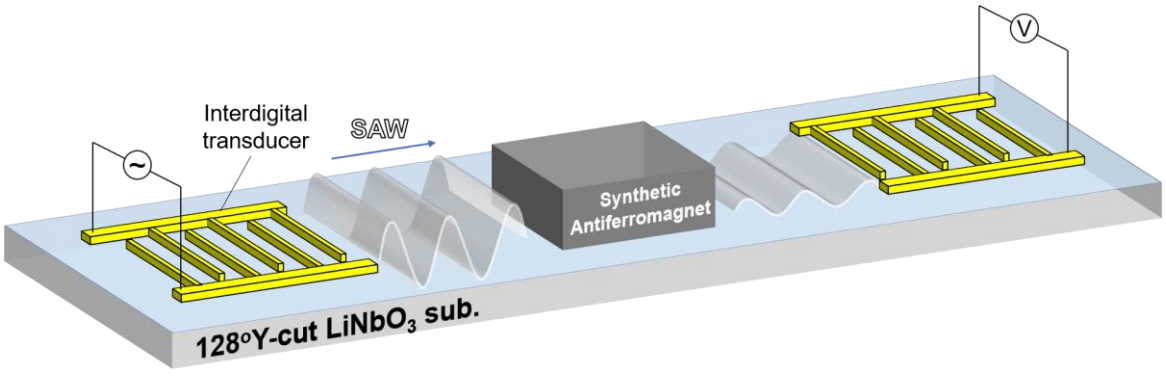

Fig. Schematic illustration of the SAW transmission measurement.

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[3] R. A. Gallardo *et al.*, *Phys. Rev. Appl.* **12**, 034012 (2019).

[4] R. Verba *et al.*, *Phys. Rev. Appl.* **12**, 054061 (2019).