音響電流測定によるスピン波共鳴の検出

Spin wave resonance detected from acoustoelectric current in a thin metallic film

東大理 [1]　○松本 啓岐 [1]，川田 拓弥 [1]，河口 真志 [1]，林 将光 [1]

The Univ. of Tokyo [1]

○Hiroki Matsumoto[1], Takuya Kawada[1], Masashi Kawaguchi[1], and Masamitsu Hayashi[1]

E-mail: hmatsumoto@g.ecc.u-tokyo.ac.jp

Surface acoustic wave (SAW) can induce spin wave resonance (SWR) in a ferromagnetic thin film due to magnetoelastic coupling [1,2]. Such SAW-driven SWR (SAW-SWR) can be exploited to study the coupling between magnons and acoustic phonons in ferromagnets. With regard to application for quantum computing and communication, achieving coherent interaction between magnons and acoustic phonons is essential [3].

To investigate strongly coupled magnon-phonon in a conventional SAW device, high-frequency measurement using a spectrum analyzer has often been employed. However, it is difficult to observe the small change in the SAW power associated with the coupling. In this work, as a novel approach to the problem, we show that *DC measurement* of acoustoelectric current can be used to detect the SAW-SWR.

We fabricated a structure including a Ni layer on a 128°Y-cut $LiNbO_3$ substrate between two interdigital transducers (IDT). The structure is located at the center of the delay line. Then we developed Ta layers and electrodes at the left and right side of the delay line. We measured DC voltage in each of the Ta layers while exciting SAW and sweeping an external magnetic field. We found that the voltage at one of the Ta layers decreases under a small magnetic field. On the other hand, the voltage of the other Ta layer did not show any significant changes. The results imply that acoustoelectric current decreases after going through Ni because SAW power is transferred to the magnons there. Further details of the experimental results and their interpretation will be discussed.

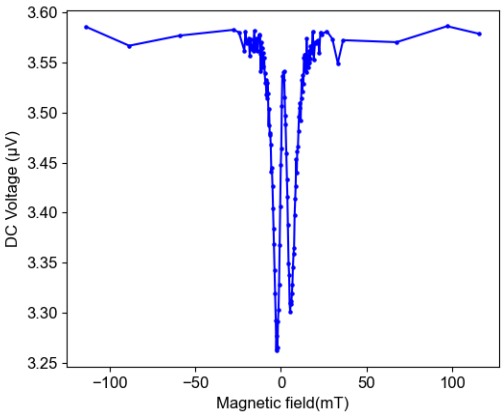

Fig. Magnetic field dependence of DC voltage in one of the Ta layers.

This work was partly supported by JSPS KAKENHI (Grant Nos.20J20952) from JSPS, and JSR Fellowship, the University of Tokyo.

[1] M. Weiler *et al.*, *Phys. Rev. Lett.* **106**, 117601 (2011).

[2] L. Dreher *et al.*, *Phys. Rev. B* **86**, 134415 (2012).

[3] Y Li *et al.*, *APL Mater.* **9**, 060902 (2021).