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Ferromagnetic resonance of CoFeB detected by tunnel anisotropic magnetoresistance

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Spin-torque diode effect [1] is an effective tool for a highly sensitive detection of the magnetization dynamics [2]. The diode effect usually results from a ferromagnetic resonance (FMR) induced by spin-transfer- or voltage-torques and is detected by tunnel magnetoresistance (TMR). Observation of the diode effects therefore need two ferromagnetic layers, that is, free and reference magnetic layers

In the present study, we tried to detect FMRs in a tunnel junction using just one ferromagnetic layer. We prepared a $Co_{60}Fe_{20}B_{20}$(1.4 nm)/MgO(1.9 nm)/Ta(10 nm) multilayer by magnetron sputtering systems since the combination of a magnetic layer and MgO/Ta is known to show tunneling anisotropic magnetoresistance (TAMR) [3]. The multilayer was post-annealed at 300℃ and patterned into the junction with 5 μm in a diameter (Fig. 1a). The resistance-are product was 2.9 kΩμm^2. The TAMR was measured under perpendicular magnetic field, and one's ratio was 0.3%. Firstly, a microwave current was applied into the junction to excite a FMR in the CoFeB. Then the FMR signal was detected as a DC homodyne voltage measured using a lock-in amplifier. The FMR spectra were clearly obtained as shown in Fig. 1b. The FMR signals (~0.5 μV) are hundreds times smaller than those of the FMRs detected by TMR with similar structure [4], and the decrease in the FMR signals is almost same as that in the MR ratio. The FMRs of the CoFeB is hence excited by voltage-induced torque and detected by TAMR. This work was supported by Grant-in-Aids for Scientific Research (S) and Scientific Research on Innovative Area.

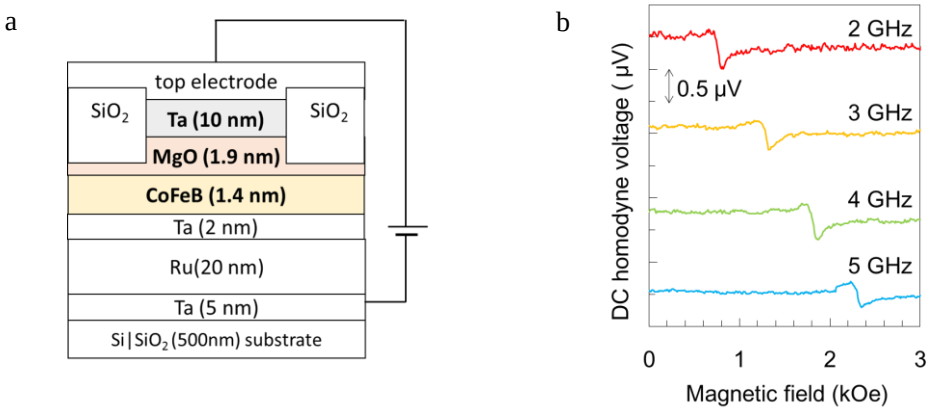

Figure 1　(a) Device structure.　(b) Typical FMR spectra of CoFeB detected by TAMR.

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