

熱誘起磁気異方性変化による巨大スピントルクダイオード効果

Giant spin-torque diode effect induced by heat induced magnetic anisotropy change

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Magnetic tunnel junctions (MTJs) have been promising device for application in microwave frequency region, such as spin-torque diode effect [1]. Recently, Miwa *et al.* reported that the sensitivity of the spin-torque diode effect exceeds that of semiconductor diode [2]. To realize higher diode sensitivity, an efficient spin-torque is significant. We have reported that the Joule heating induces the efficient spin-torque due to the large and fast magnetic anisotropy change [3, 4]. In this study, we report that giant spin-torque diode sensitivity due to the heat induced anisotropy change.

The samples, buffer layer | IrMn (7.0) | CoFe | Ru | CoFeB | MgO barrier (1.0) | FeB (2.0) | MgO cap (0.5) | metal cap, were deposited on silicon substrates by the magnetron sputtering. The MTJ with the diameter of 190 nm was fabricated by an electron beam lithography. The spin-torque diode voltage of dc-biased MTJ was measured by the conventional measurement system of spin-torque diode effect [2]. Magnetic field of 50 mT was applied along the azimuthal angle of 11° and in-plane rotation angle from pinned layer magnetization of 135°. Figure 1 shows the microwave power dependence of diode voltage under the dc-bias voltage of approximately 400 mV. Linear power dependence was observed less than $P = 10^{-8}$ W (red dashed line). As a result, we obtained the diode sensitivity of 1.4×10^6 V/W. This value is 300 times larger than the limit of semiconductor diode sensitivity of 3,800 V/W.

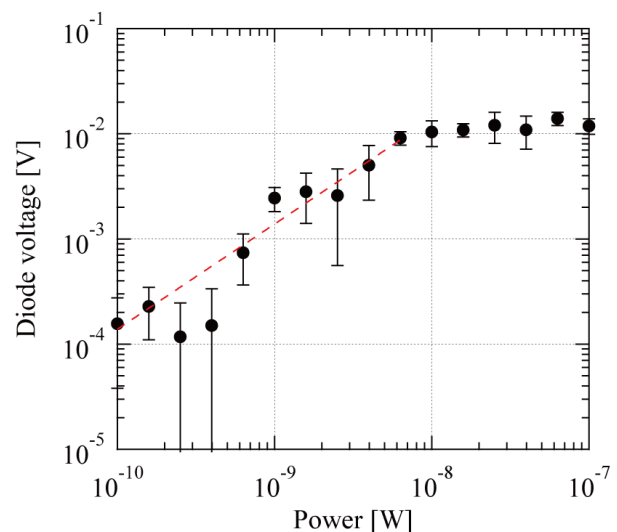


Figure 1 Microwave power dependence of spin-torque diode voltage.

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- [2] S. Miwa *et al.*, Nat. Mater, **13**, 50 (2014)
- [3] M. Goto *et al.*, Nat. Nanotechnol, **14**, 40 (2019)
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