Voltage modulation of interfacial spin direction at MnIr|MgO with triple-Q spin state

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Antiferromagnetic materials attracts a great attention in spintronics for developing high speed and high density spin devices. To realize such spin devices, electrical control of antiferromagnetic spin is essential. Recently, electrical control of antiferromagnetic spin was reported in MnIr [1]. The result seems to suggest that the electric field modifies interfacial spins at MnIr|MgO. To understand the interfacial spin in detail, in this study, we investigated the interfacial spin driven by electric field measured by tunneling anisotropic magnetoresistance (TAMR [2]) effect which can detect interfacial spin direction.

We employed the NiFe|MnIr|MgO|Ta tunnel junction fabricated by magnetron sputtering, photo-lithography, and Ar ion milling as shown in Fig. 1. The TAMR curve in MnIr|MgO|Ta tunnel junction was measured under dc voltage. In order to extract the modulation of interfacial spin direction, we normalized the TAMR curve by its TAMR ratio as shown in Fig. 2. We have found that the line width of peak at B_z = 0 depends on the dc voltage. The results can be explained by voltage modulation of magnetic anisotropy in triple Q type spin structure [3] of γ-MnIr.

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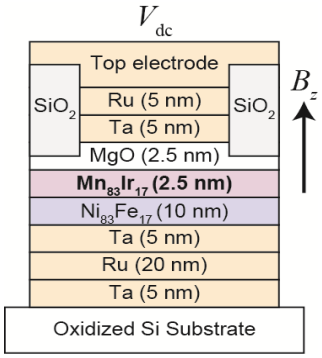

Fig. 1 Film structure

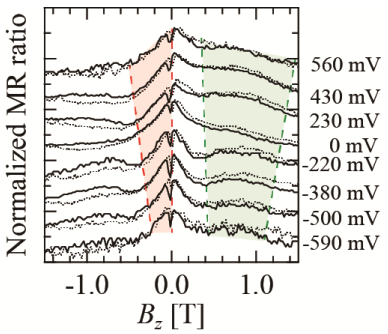

Fig. 2 MR curve of MnIr|MgO|Ta junction under dc voltage

[1] Y. Wang, *et. al.*, Adv. Mater, **27** 3196 (2015)

[2] B. G. Park, *et. al.*, Nat. Matter, **10** 347 (2011)

[3] A. Sakuma, *et. al.*, Phys. Rev. B, **67** 024420 (2013)