

Anomalous ISHE in Pt/Py System Due to Surface Oxidation on Py Layer

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The generation and detection of a spin current through inverse spin-Hall effect (ISHE) phenomena are the important technique for developing applied spintronic devices. The ISHE has been observed using the spin-pumping[1,2] and the non-local method[3] in Py/Pt films. Above all, the spin pumping method represent to the generation of spin currents from precessing magnetization in a ferromagnetic/paramagnetic bilayer system. And then a spin current is pumped out of the ferromagnetic layer into the paramagnetic layer in the ferromagnetic resonance (FMR) condition. The FMR linewidth and spectroscopy measurement technique provides a convenient way for not only measuring the Gilbert damping constant and the saturation magnetization in magnetic layer[4] but also material characterization such as composition[5].

In our experiment, FMR signal and output voltage of ISHE behavior depending on the magnetic field are distorted according to the exposed time into atmosphere. This dependency severely reduces the accuracy of the experimental results. As shown in Fig. 1 (a), the FMR curve compare as-dep. and 240 hours passed. For the Py/Pt sample after 240 h passed, the amplitude of absorption peak is decreased at H_0 (resonance field) = 1 kOe. And additional resonance peak is appeared at 3 kOe such as similar with that of Fe_2O_3 . Therefore we can estimate to be generated iron oxide due to exposure of atmosphere. According to the oxidation of Py layer, the electric voltage is measured in Py/Pt films by using ISHE, the oxidation of Py layer is a reason that the output voltage reduction and distortion in Fig.1(b). To make the conclusive results, surface analysis measurement such as ellipsometry, X-ray Diffraction (XRD), and X-ray Photoelectron Spectroscopy (XPS) is carried out. So a possible origin of distorted output voltage signal for oxidation of Py layer will be discussed in detail.

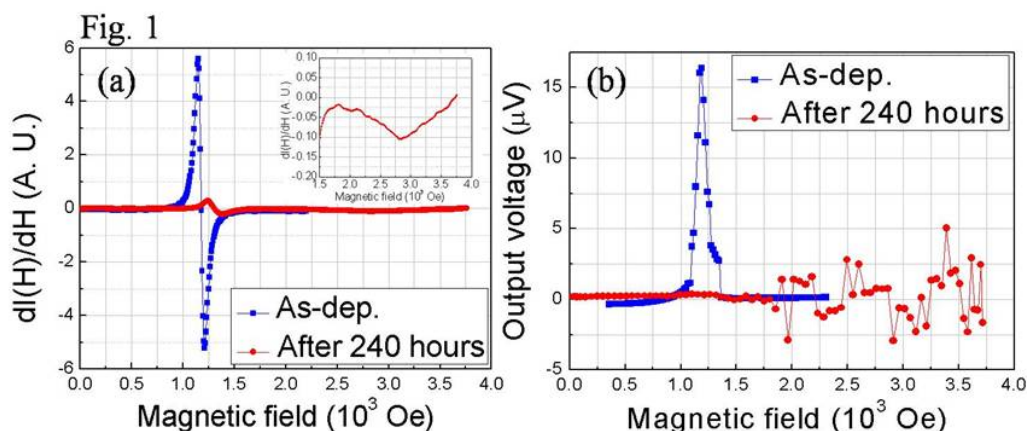


Fig. 1. (a) The FMR curve compare as-dep. sample and Pt/Py sample after 240 hours. (b) The output voltage as a function of magnetic field in Pt/Py sample.

References

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