Ferromagnetic Resonance and Inverse Spin Hall Effect in Permalloy/Pt bilayers

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The temperature dependence of magnetodynamical physical effects such as Spin Pumping and Inverse Spin Hall effect (ISHE) has been measured in a set of Py/Pt bilayers as a function of the Pt thickness. Additionally, important physical parameters such as Gilbert damping, saturation magnetization and anisotropy field have been determined as well. We found that the Gilbert damping follows a non-monotonic behaviour with temperature (**Fig. 1**), as reported in other systems [1]. Previous measurements on the temperature dependence of Spin Pumping and ISHE [2] in this system have the serious drawback of requiring the use of complex fabrication process to prepare the samples. In this work we present an easy-to-implement ferromagnetic resonance (FMR) setup for measuring all those effects and parameters straightforwardly. We found that the amplitude of the FMR absorption curves is constant from room temperature to approximately 100K and then it starts to decrease. Because of this reduction, it is of major relevance to normalise the measured ISHE voltage with the FMR absorption amplitude in order to obtain physically coherent results. The resulting normalised ISHE voltage, depicted in **Fig. 2**, follows an inverse linear relation with temperature.

References

[1] Lu, Guangduo, et al., Journal of Alloys and Compounds, 753 (2018) 475-482
[2] Obstbaum, M., et al., Physical Review B, 89.6 (2014), 060407

Figures

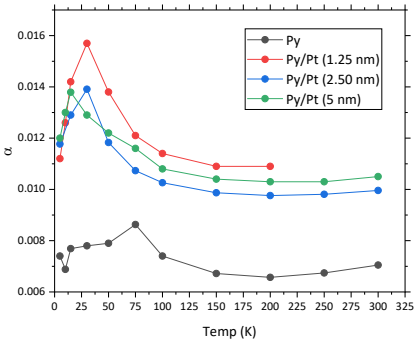

Figure 1: Temperature dependence of the Gilbert damping of the Py/Pt system as a function of the Pt layer thickness.

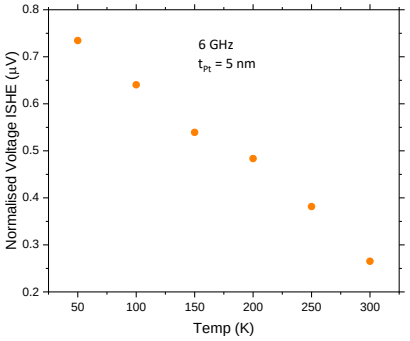

Figure 2: Temperature dependence of the normalized ISHE in a Py (20nm)/Pt (5nm) bilayer at 6 GHz.