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Spin-charge conversion in single-layer graphene at room temperature

Osaka Univ. [1], Kyoto Univ.[2], Kyushu Univ.[3]

○R. Ohshima[1], A. Sakai[1], Y. Ando[1, 2], T. Shinjo[1, 2], K. Hamaya[1]

K. Kawahara[3], H. Ago[3] and M. Shiraishi[1, 2]

E-mail: ryouoohsima107@s.ee.es.osaka-u.ac.jp

Single-layer graphene (SLG) is a greatly attractive material in molecular spintronics because of its high mobility and large spin-diffusion length due to its small spin-orbit interaction (SOI) [1]. In fact, electrical [2] and dynamical [3] spin transport in SLG was realized at room temperature (RT). Recently, an observation of dynamical spin injection and spin-charge conversion by the inverse spin Hall effect (ISHE) in a conductive polymer, which is composed of light elements as SLG, gave a great impact on molecular spintronics [4]. This result indicates that sufficient spin accumulation allows to induce an electromotive force due to the ISHE even in materials with a small SOI, and so it is expected that SLG can become a platform for the spin-charge conversion because of its non-zero SOI.

Here we demonstrate a spin-charge conversion in SLG at RT by using dynamical method. We chose yttrium-iron-garnet ($Y_3Fe_5O_{12}$, YIG), which is a ferromagnetic insulator, as a spin source and used large-area SLG grown by chemical vapor deposition (CVD). The spin current was pumped from the YIG into the SLG under the ferromagnetic resonance condition of the YIG. Fig. 1 shows the electromotive force by ISHE and the spin Hall angle of SLG is estimated to be 6.1×10^{-7} [5].

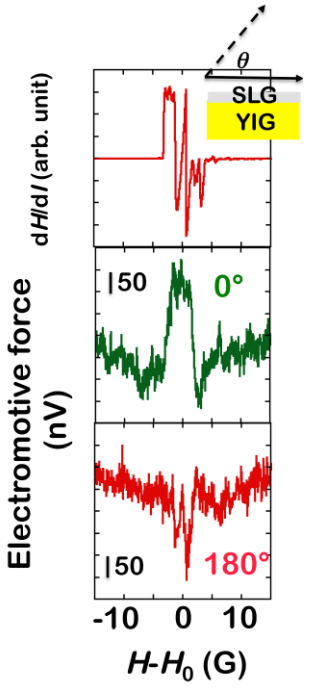

Figure 1: The FMR spectrum of the YIG at θ=0° (the upper panel) and the electromotive force in SLG/YIG at θ=0° and θ=180° (the middle and bottom panels).

References

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