Efficient spin injection and absorption using CoFe-based alloys

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Generation, manipulation and detection of spin currents are important issues in the operation spintronic devices because a spin current plays an important role in spin-dependent transport and spin-transfer switching. Especially, pure spin current which is the spin current without accompanying the charge current is an attractive quantity for utilizing the spin current efficiently. Nonlocal spin valve measurementsin laterally configured ferromagnetic metal(FM)/nonmagnetic metal (NM) hybrid nanostructures is a powerful means for evaluating the intriguing properties of pure spin current precisely. In this talk, I will introduce materials for the efficient generation and detection of the pure spin current and a structure for efficient control of the absorption property of the pure spin current.

In the first part, I will introduce the results on the efficient generation of pure spin current using CoFeAl. We show that CoFeAl alloy is an excellent material not only for the electrical spin injection but also thermal spin injection because of its favorable band structure as schematically shown in Fig. 1.[1]

In the second part, I will introduce an unconventional lateral spin valve structure, in which the pure spin current flows in a FM/NM bilayer shown in Fig. 2. We show that the effective spin diffusion length can be modulated by the direction of the magnetization of the FM layer in the spin-current channel.

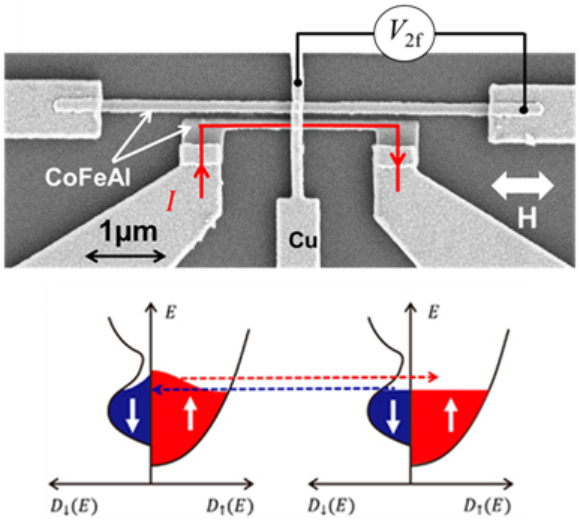

Fig. 1 Schematic illustration of the efficient spin injection together with a SEM image of lateral spin valve

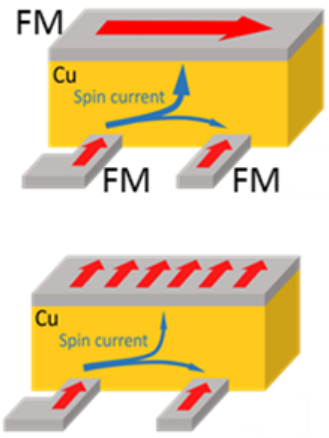

Fig. 2 Conceptual image of modulation of the spin absorption.

Reference

[1] S. Hu, H. Itoh and T. Kimura: NPG Asia Mater. 6, e127 (2014).