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Spin Current Generation and Utilization in Metals and Insulators

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1. Introduction

Utilization of a spin current, a flow of electrons' spins in a solid, is the key technology in spintronics that will allow the achievement of efficient magnetic memories and computing devices. In this technology, generation and detection of spin currents are necessary. Here, we review inverse spin-Hall effect and spin-current-generation phenomena recently discovered both in metals and insulators: inverse spin-Hall effect, spin pumping, and spin Seebeck effect.

2. Spin pumping and spin torque in a Mott insulator system

We found that spin pumping and spin torque effects appear also at an interface between Pt and an insulator YIG.. This means that we can connect a spin current carried by conduction electrons and a spin-wave spin current flowing in insulators. We demonstrate electric signal transmission by using these effects and interconversion of the spin currents (Fig. 1) [1].

3. Spin Seebeck effect

We have observed, by using the inverse spin-Hall effect [2,5], spin voltage generation from a heat current in a NiFe, named the spin-Seebeck effect [3]. Surprisingly, spin-Seebeck effect was found to appear even in insulators (Fig. 2) [4], a situation completely different from conventional charge Seebeck effect. The result implies an important role of elementary excitation in solids beside charge in the spin Seebeck effect. In the talk, we review the recent progress of the research on this effect.

Acknowledgement

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Reffernces

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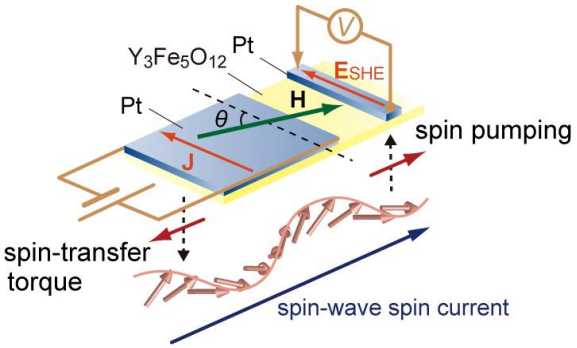

Fig. 1 Concept of the spin-current interconversion using spin-Hall effect.

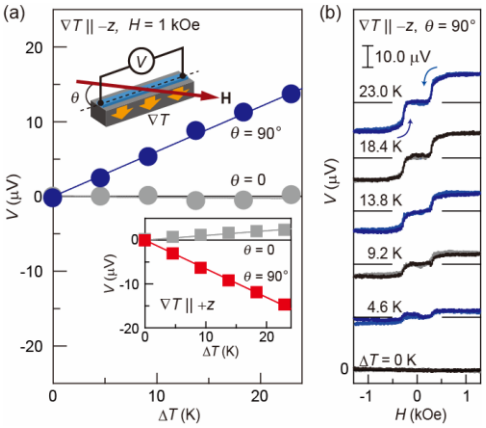

Fig. 2 (a) Experimental setup for spin Seebek effect and temperature dependence of spin-Seebeck voltage. (b) Magnetic-field dependence of spin-Seebeck effect.