

Reciprocal relation between spin Peltier and spin Seebeck effects

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In recent times, the interaction between magnetization and heat currents in a magnetic material has gained a renewed interest thanks to the observation of the spin Seebeck effect (SSE) [1,2]. The SSE is the spin counterpart of the Seebeck effect that corresponds to the generation of a pure magnetization current in a magnetic insulator as consequence of a thermal gradient. This is electrically detected by means of the inverse spin Hall effect [3], that rises in a high spin orbit coupling heavy metal deposited on the magnetic insulator. As in the ordinary thermoelectricity, the SSE has its reciprocal effect that is the spin Peltier effect [4,5]. In this work we provide an experimental proof of the reciprocal relations between SSE and SPE [6,7] in a single bulk sample of yttrium iron garnet (YIG) covered by a platinum thin film. For both the SSE and the SPE experiments, we employ a measurement system designed for the detection of heat currents exchanged between the thermal reservoirs and the sample under test. The sample-specific value for the characteristics of both effects measured on the present YIG/Pt bilayer is $(6.2 \pm 0.4) \times 10^{-3} \text{ KA}^{-1}$ at room temperature, that corresponds to the spin-analogue of the Thomson relation between thermoelectric effects.

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Summary

Topic

1. Nanomagnetism and Spintronics

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