CP10

Spin Accumulation and Precession in Py/Au Lateral Spin Valves

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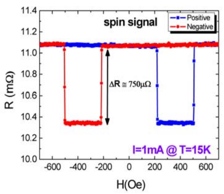
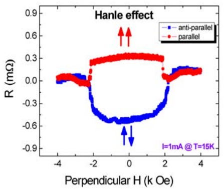
The orientation of an electron spin injected in nonmagnetic metal is the result of the interaction of the intrinsic magnetic moment of a spin with the magnetic fields in which the spin is moving. In the presence of a uniform magnetic field, the spin precesses coherently around the field's direction and its orientation changes with a uniform precession frequency. In a diffusive metal, a nonuniform effective magnetic field arises from the spin-orbit interaction and it is responsible for the randomization of the spin orientation. Hanle effect is widely used to induce a spin accumulation in a nonmagnetic metal resulted from effective spin injection from ferromagnetic metal because it stems from precession of injected spins under perpendicular magnetic field. Very clear Hanle effects were reported in nonmagnetic metal such as Al and Cu. [1,2] However, no works have shown Hanle effect in Au because spins in Au are easy to randomize owing to high spin orbit interaction. In this experiment, we systematically study on spin accumulation and precession in Au by observing Hanle effect.

For the device fabrication, 40-nm-thick Au channel was patterned on an oxidized Si substrate. Various Au channel width are 0.2~0.5 μm. 80-nm-thick Py ($Ni_{81}Fe_{19}$) electrodes with a different aspect ratio are fabricated on a pre-patterned Au channel. The measurements were performed by the standard ac lock-in-techniques with an excitation current 1 mA at 15 K in non local geometry. Fig. (a) shows typical NL signal measured at 15K. Resistance change of ΔR = 0.75 mΩ was detected between the parallel and anti-parallel states of two Py electrodes. Fig. (b) shows the Hanle signal of Py/Au/Py spin valve in the presence of an out of plane magnetic field. The resistance change between two different states (parallel / anti-parallel) is well matched with ΔR in Fig (a). The Hanle signal in Au can be discussed in terms of spin relaxation length and channel length of Au.

(a)



(b)



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CP11

High mobility InAs/AlSb 2DEG HEMT on GaAs for SPIN-FET and Effect of p-/n- doping on InSb/GaAs

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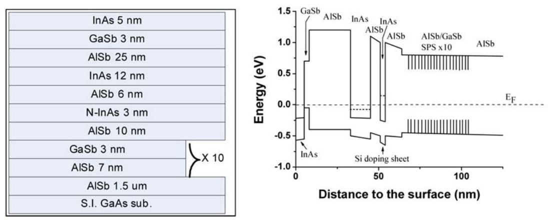
During recent decade, InAs-based 2 DEG has attracted attention as a promising candidate for the SPINTRONICS application due to larger spin length compared with conventional GaAs and InP-based materials. However, to achieve high-quality InAs 2DEG on conventional GaAs (0.565 nm) or InP (0.587 nm) wafers of smaller lattice-constant, special growth technology to overcome this large lattice-mismatch is required.

Here we report conventional (forward) and backward InAs 2DEG HEMT of suitable quality for high-speed low-power-consumption application and SPIN-FET application, respectively. The room-temperature (RT) and 77K mobilities of forward HEMT are 21,690 and 56,890 cm^2/Vs, respectively. For backward HEMT, we achieved RT and 77K mobility of 28,270 and 160,330 cm^2/Vs, which are 3 times larger values of the same structure of ref [1]. Those will be supplied to high-speed transistor technology and realization of SPIN-FET.

InSb holds ~70,000 cm^2/Vs of RT-mobility and ~ 0.18 eV of bandgap. As a result, many researchers focus on fabrication of high-quality magnetic sensor and infrared sensor (~3 um). Here, we will report the effect of p-/n- doping at InSb material on its physical properties.



(a) (b)

Fig. 1. The schematic structure of InAs/AlSb 2DEG on GaAs and (b) bandgap diagram.

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