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Spin Hall effect in Au films

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The spin Hall effect was first proposed by Dyakonov[1] and Perel. Hirsch[2] proposed an experiment to generate and detect a spin current in a paramagnetic metal. In spin-orbit-coupled system a nonzero spin current is predicted in a direction perpendicular to the applied electric field, giving rise to a "spin Hall effect". In terms of this effect, electrically-induced spin polarization was recently detected by optical and electronic measurement[3]. Here we report electrical measurements of the spin-Hall effect in Au films. In our devices, we observed an induced voltage that results exclusively from the conversion of the injected spin current into charge imbalance through the spin Hall effect. These experiments reveal opportunities for efficient spin direction without the need for magnetic materials which could lead to useful spintronics devices.

The device has been fabricated by photo and e-beam lithography. A 100-nm-thick Au film was deposited by thermal evaporation. Two ferromagnetic electrodes with the thickness of 50 nm have been fabricated by e-beam evaporation of a single Co source. Two ferromagnetic films of different aspect ratio exhibit different coercivity. The SEM image of fabricated our spin Hall device is shown in Fig. 1.

In our experiments, a ferromagnetic electrode is used to inject spin-polarized electrons into Au film. We have measured spin Hall effect in Au films. Fig. 2 shows spin Hall effect. We have investigated spin Hall effect of which properties change according to channel gap in our sample.

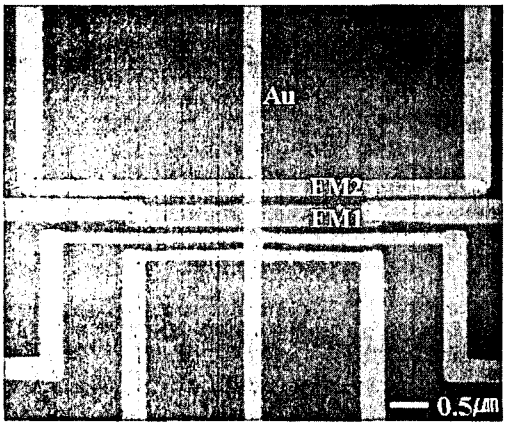

Fig. 1. Scanning electron microscope image of the spin Hall device.

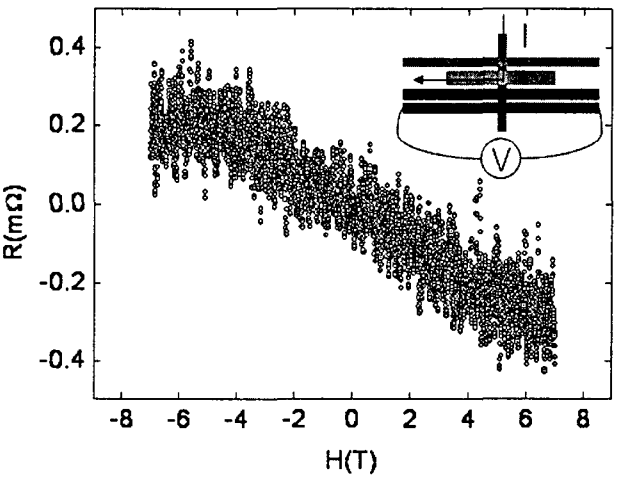

Fig. 2. The spin Hall effect at 4.2K

References

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