

Spin injection and accumulation in Py/Pt/Py spin valve devices

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Spin injection from a ferromagnetic metal into a nonmagnetic material is an essential ingredient for the success of spin transport device. Efficient electrical measurements of spin injection and detection are of great importance for comprehension of spin based electronic devices. Spin injection into nonmagnetic metal has attracted much attention because spin current isn't hampered by the conductance mismatch at the interface as both spin injector and channel are metals. Some previous reports have shown successful spin injection into nonmagnetic metals such as Cu, Al, Au, and Ag in an attempt to understand the nature of spin injection and accumulation in nonmagnetic metals.¹⁻⁵

In this study, Pt(platinum) was chosen as a spin transport channel because its spin orbit interaction parameter compared to the d-bandwidth of Pt (0.32) is located between Ag(0.22) and Au(0.47) which were already proved it to have high spin injection polarization.⁶

Our device used in the experiment was a lateral spin valve devices. It consist of a Pt film as the spin transport channel and Py film as electrodes for spin injection and detection. 30nm thickness Pt film was deposited by an electron-beam lithography and lift off process. 80nm thickness Py film was deposited by an electron-beam evaporator. It prepared some devices with different center to center distance between Py1 and Py2 ranging 550 to 733nm. The width of the Pt channel was fixed at 200nm in this experiment. It measurement including the anisotropic magnetoresistance(AMR) of the Py's as well as spin transport effects in the local spin valve(LSV) and nonlocal spin valve(NLSV) measurement.

We report successful spin injection into Pt by using lateral Py/Pt/Py spin valve devices. LSV signal the observation of memory effect confirms successful spin injection into Pt. The spin injection polarization and spin diffusion length of Pt was evaluated to 18% and 120nm at 5K respectively based on LSV measurement.

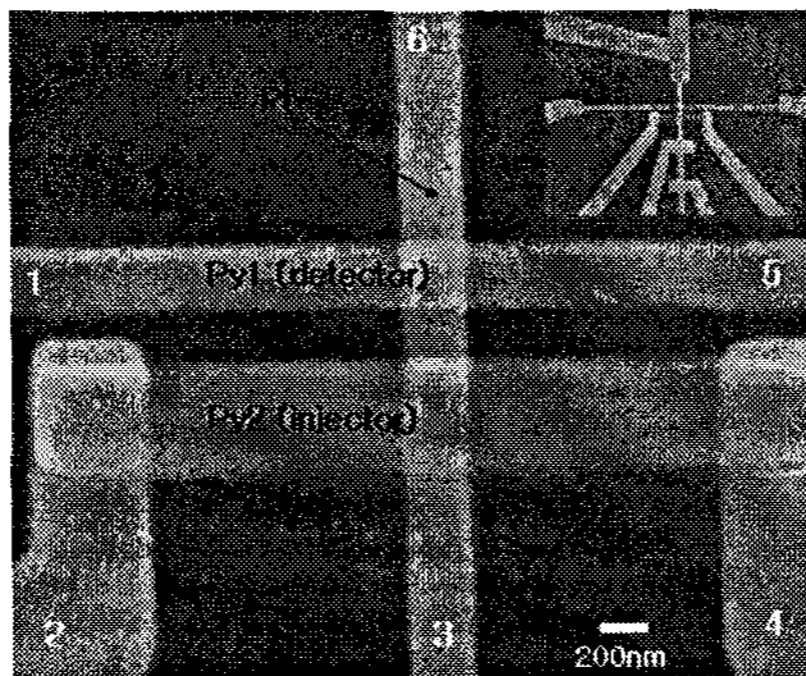


Fig. 1. Scanning electron micrograph of the Py/Pt/Py lateral spin valve device.

Reference

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