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Spin Injection and Accumulation in Metallic Lateral Spin Valves with Transparent Contacts[1]

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Creation and control of spin currents is a key ingredient in spintronics, which has as a goal the use of both the spin and charge of the electron. Ferromagnetic (FM)/non-magnetic (NM) lateral spin valves are powerful devices that decouple a pure spin current from an electrical current by using a non-local geometry. We will review previous works to show how the FM/NM interface and materials control in an essential way the generation and manipulation of a spin current in non-local spin valves (NLSV). For this reason, we have studied the electrical spin injection and spin accumulation in metallic NLSV with transparent interfaces as a function of important experimental parameters such as injection current direction and magnitude, temperature, materials, and thickness. Using injected DC currents we find that the spin injection is perfectly symmetric when injecting current *from* the FM or *into* the FM, causing exactly the opposite spin accumulation in the NM. This provides means for a pure electrical manipulation of the spin current polarity. The change in spin accumulation with increasing injected current is produced by a temperature raise of the device due to Joule heating and confirmed by independent spin accumulation measurements as a function of temperature. Comparing experimentally measured spin accumulation in NMs with a spin-diffusion model allows us to identify the effect of surfaces on the spin diffusion length and injection efficiency, and the effect of FM electrodes on spin accumulation. These experiments have important implications for the physics of NLSV and for the development of devices based on these phenomena.

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