Spin transport in an FM/Bi/FM junction

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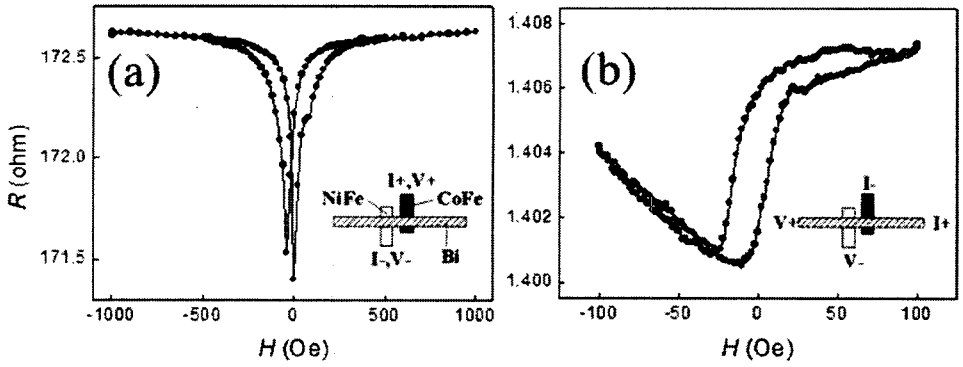
We present the spin transport in a spin-injection device, consisting of Bi film and two ferromagnetic contacts: a spin injector (NiFe) and a detector (CoFe). The magnetoresistance (MR) for the as-sputtered Bi film was hardly observed at 4 and 300 K, whereas after annealing the MR ratios were found to reach 30,000 % at 4 K and 600 % at 300 K. In particular, the room temperature MR was found to depend on the grain size before and after annealing. The thickness dependence of MR was also found in the range 1 - 20 μm, indicating that the carrier mean free path *l* for the films is of the order of a few ten μm. Due to the long carrier mean free path *l*, the Bi thin film is expected to be a good spin channel for demonstrating spin injection. A spin-injection device based on the Bi films has been fabricated using standard photolithography process. The NiFe and CoFe contacts are 10 μm wide and the Bi spin channel is 1 μm long. The spin transport in the device was investigated at 2 K by spin-valve measurement (a) and non-local measurement (b) [see Fig.1]. For the spin-valve measurement, it is likely that the MR behavior is attributed to anisotropic MR of NiFe and CoFe since the magnitude of resistance for Bi is comparable to that for the two ferromagnetic contacts. On the other hand, for the non-local measurement, the hysteretic feature was observed in the field range $-100 < H < +100$ Oe, which is similar to MR response in spin injection studies of Nb film and InAs 2DEG. The detailed mechanism for the detection of spin-polarized electrons injected into the Bi film will be discussed.



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