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A study of FANOUT function in current driven spin memory and logic

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Current driven domain wall studies are very attractive for future green computing such as memory spin logic etcetera. Using an amorphous TbFeCo magnetic wire, we have reported the lowest value of critical current density of 3×10^{6}A/cm^{2} for domain wall motion. It is 10 times smaller than that of Co/Ni magnetic wires. And also, we have reported a new concept of current driven spin logic. AND, OR and NOT demonstrations with small current operation has been reported. It is simple operation mechanism for spin logic compared with other spin logic proposals, such as rotational magnetic field driven spin logic, and spin wave logic. Therefore an ideal memory and logic device can be designed. However, to confirm the potential as a spin logic device, FANOUT function should be also investigated. Here, the FANOUT operation of the current driven spin logic will be introduced.

Fig.2 shows the experimental set up. The magnetic wire structure is Pt(2nm)/TbFeCo(7.3nm) which was deposited on the Si substrate. The saturation magnetization Ms was about 100emu/cm^{3}. The coercive force was about 1.0kOe.

The domain wall motion was carried out as following procedures. At first, to initialize magnetic field toward the substrate was applied to initialize the magnetization of the wire. Subsequently, in order to introduce DW into the wire, a negative magnetic field of -330Oe was applied to the opposite direction to the wire. Then the DW recorded at the initial position as shown in Fig.2 (a). When current (1.05×10^{7}A/cm^{2}) is injected into the wire, the recorded DW starts to move toward the right hand side, then the single DW is successfully divided in two at the wire branches as shown in Fig.2 (b).

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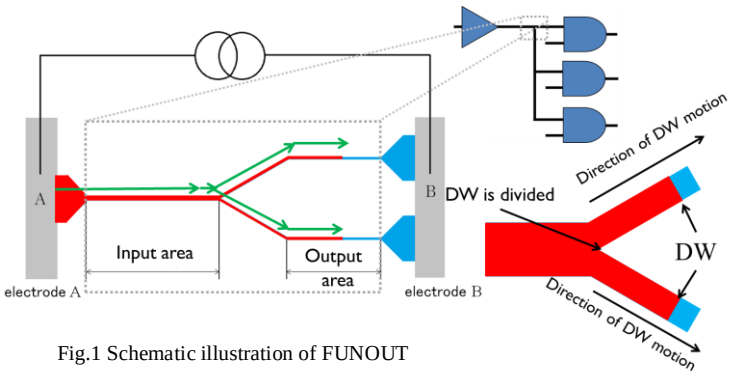

Fig.1 Schematic illustration of FUNOUT

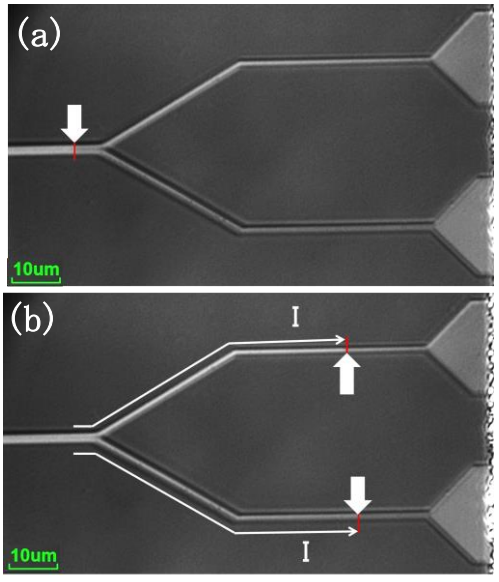

Fig.2 Polar Kerr optical microscope image of DW motion by injecting DC current, 1.05×10^{7}A/cm^{2}. (a) Induced DW and (b) divided by injecting DC current.