Y 字磁性細線を用いた電流誘起磁壁移動ロジックの研究 Investigation of Y-shaped magnetic wire logic device by current-induced domain wall motion 九大シス情¹,豊田工大²,九大理³,九大スピンセ⁴0黒川 雄一郎¹,若江 将和¹,伊藤 正裕¹, 驚見 聡²,粟野 博之²,大西 紘平^{3,4},湯浅 裕美¹ Grad. Sch. & Fac. of Info. Sci. & Elec. Eng., Kyushu Univ.¹, Toyota Tech. Inst.², Dept. of Phys.,

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[Introduction] Manipulating magnetic domain wall (DW) using electric current has been paid much attention from the viewpoint of device application such as new types of magnetic memories and logic circuit. In previous study, we have reported magnetic wire logic device using current-induced domain wall motion (CIDWM) whose driving force is spin transfer torque. Recently, the CIDWM by spin orbit torque (SOT) originated from the spin Hall effect (SHE) and Dzyaloshinsky-Moriya interaction (DMI) has been

reported. In this study, we observed logic operation in Y-shaped magnetic wire using CIDWM by SOT.

[Experiment] Ta/GdFe wire was deposited on a thermally oxidized Si substrate by using DC magnetron sputtering. The Y-shaped magnetic wire was fabricated by electron beam lithography. The magnetic properties of Ta/GdFe wire was observed by using anomalous Hall effect. The logic operation was observed by using Kerr microscope.

[Result] Figure 1 shows AND logic operation in the Gd-Fe wire. The 1 or 0 states correspond to up or down magnetization. When input corresponds to 1,0 or 0,1, the domain wall could not go through junction. As a result, the output can be 0. Oh the other hand, when the input corresponds to 1,1, the domain wall could go through junction shown in the Fig. 1. Therefore, the output can be 1. It indicates that Y-shaped magnetic wire can be used as AND logic device.



Figure 1 Kerr images of AND logic operation in Gd-Fe wire

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