Co/Ni 多層磁性細線によるレーストラックメモリの動作に関する研究

Investigation of operation for racetrack memory using Co/Ni multilayer wire

九大シス情[1] ○長谷川 博一[1], 黒川 雄一郎[1], 湯浅 裕美[1]

Kyushu Univ.[1], ○Hirokazu Hasegawa[1], Yuichiro Kurokawa[1], and Hiromi Yuasa[1]

E-mail hasegawa.hirokazu759@s.kyushu-u.ac.jp, ykurokawa@ed.kyushu-u.ac.jp

[Introduction]

Racetrack memory is one of the non-volatile magnetic memories which can realize fast operation and high data density. The magnetic domain is used as data bits and domain wall (DW), which is in between domains, can be controlled by a spin orbit torque (SOT) generated from an electric current. In this study, we investigate the DW operation in racetrack memory using Co/Ni multilayer wire with SOT.

[Experiment]

A Ta (2nm)/Pt (2nm)/Co (0.3nm)/Ni (0.7nm)/Co (0.15nm)/Ta (3.5nm) multilayered film was fabricated on a thermally oxidized silicon substrate using DC magnetron sputtering. The T-shaped wire was fabricated using photolithography and Ar ion milling. The motion of magnetic domain induced by a SOT was observed by a polar Kerr microscope.

[Result]

The writing and bit shift operation were observed in two steps, 1) writing process and 2) shifting process. 1) To generate DW, the 1s-width pulse current was applied to T-shaped wire under an in-plane magnetic field H_x = 1 kOe. 2) The DW was shifted by 100-ns width pulse current. Thus, the writing and bit shift operation were successfully observed. Fig. 1 shows the DW velocity as a function of 100ns pulse current density of magnetic thin wires. The DW velocity is proportional to 100ns pulse current density of magnetic thin wires and its critical current density leading magnetization switch is 9.7×10^{10} A/m^2. The details of the operation will be shown in our presentation.

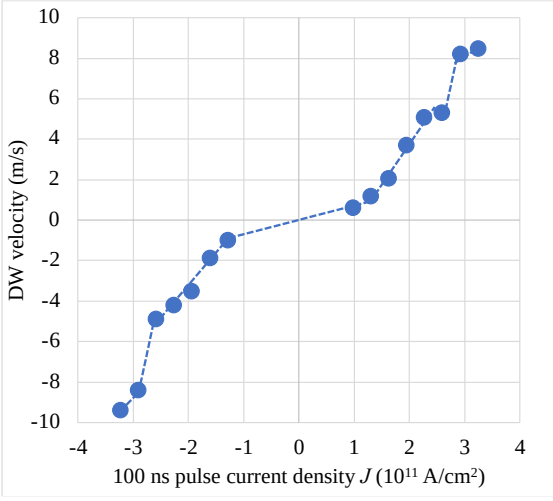

Fig. 1 DW velocity dependence on 100-ns pulse current density.

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