Higher Magnetoresistance Sensitivity Of Magnetic Sensors With Closer Junctions Deposited on Chemical-Mechanical Polishing Cu Buffer Layer

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Magnetic sensors based on Tunneling Magneto Resistance (TMR) are in use where high sensitivity, low power consumption and portability is essential such as medical, non-destructive testing, electric vehicles, etc. Multiple junctions are electrically connected for 1/f noise reduction therefore detectivity augmentation. Recently, mutual device synchronization on hall nano oscillators and investigation of their benefits are getting attraction [1]. In this manner, junctions in a device array with closer proximity may show better TMR response thus higher detectivity. In this study, we investigated effect of closer proximity on transfer curve response.

Thin films stacking was deposited in ultrahigh vacuum chamber with magnetron sputtering. Conventional 5um and promising 0.3 um distant free islands were fabricated with lithography and ion milling processes. Junctions were series connected with metal deposition to form devices. After annealing under magnetic field application, TMR characters were measured with four probe method.

Fig 1 shows optical microscope image of free islands with close proximity after Ion milling formation and resist removal. Clear dielectric isolation of free islands were succeeded even for large size islands, significantly smaller opening and tall stacking. Q-factor of milling was close to 1. Fig2 shows transfer curves of 5um conventional and 0.3um distant free island devices, closer proximity decreases magnetic anisotropy which may based on mutual synchronization of magnetic domains of islands. Response close to zero field can be seen at inset graph. Magnetoresistance sensitivity thus detection of smaller magnetic fields can be considered with closer proximity of islands.

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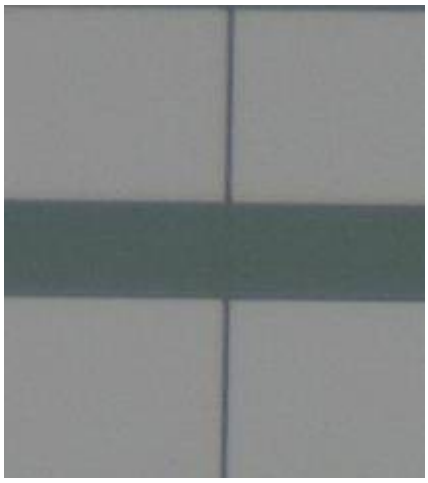

Fig1: Horizontally 0.3 um distant free islands

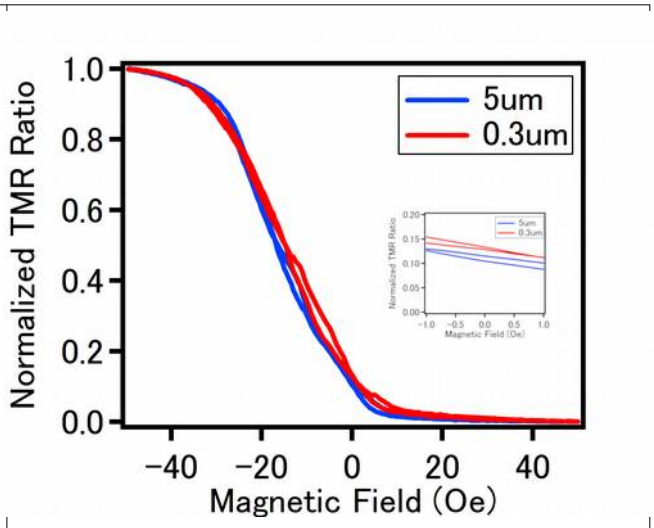

Fig2: Isolation distance effect on TMR response

[1] Awad, A. A. *et al.* Long-range mutual synchronization of spin Hall nano-oscillators. *Nat. Phys.* **13,** 292–299 (2016).