BA05

Substrate Biasing Effect during MgO Deposition in CoFeB/MgO/CoFeB MTJs

G. M. Choi[1], K. H. Shin[1], S. A. Seo[2], S. O. Kim[3], W. C. Lim[3], and T. D. Lee[3]*
[1]Center for Spintronics Research, KIST, Seoul 136-791, Korea
[2]Semiconductor Device Lab, Samsung Electronics, Yongin 446-712, Korea
[3]Department of Materials Science & Engineering, KAIST, Daejeon 305-701, Korea
*Corresponding author: T. D. Lee, e-mail: tdlee@kaist.ac.kr

After the theoretical predictions of high TMR by a coherent tunnel [1], the researches on the MTJ using MgO barreir have been performed by several groups [2-4] with its feasibility for Magnetic Random Acess Memory (MRAM). For practical application of MTJs, TMR and break-down voltage should be high and Resistance-Area product (RA) should be low at the same time.

For low RA and high TMR, oxidation of bottom CoFeB electrode should be minimized and quality of MgO (001) layer should be maximized. In this work, we have studied effects of sputtering parameters including substrate bias on TMR and RA at 2nm MgO thickness. Fig.1 shows TMR and RA change with variation of the T-S(target to substrate) distance. At a shorter T-S distance, there is possibility of the bottom electrode oxidation by oxygen ions or radicals although (001) MgO growth is favorable. At the T-S distace of 8cm, TMR was lower and RA was higher. In order to overcome these, substate bias was applied during MgO deposition as shown in Fig.2. As the bias voltage increases, TMR inceased and RA decreased. These behaviors are associated with good (001)MgO texture formation due to higher mobility of ad-atoms by energetic particles. In the presentaion, such data as sputter pressure and power depences on RA and TMR

will be presented. Also the role of bias voltage on RA and TMR will be discussed in more detail.

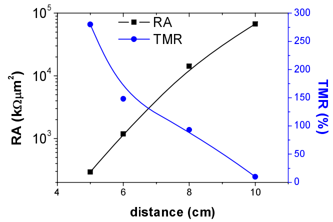

Fig. 1. T-S distance effect on TMR and RA.

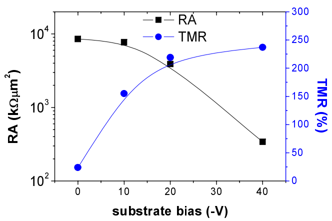

Fig. 2. Substrate bias effect on TMR and RA at T-S of 8cm.

REFERENCES
[1] W. H. Butler *et al*., Phys. Rev. B, 63, 054416 (2001).
[2] S. Yuasa *et al*., Nature materials, 3, 868 (2004).
[3] S. S. P. Parkin, Nature materials. 3, 862 (2004).
[3] Y. M. Lee, Appl. Phys. Lett., 89, 042506 (2006).

BA06

Fabrication and Characterization of Sub-100nm Magnetic Tunnel Junctions for High-Density Spin Transfer Torque MRAM

Kwang-Seok Kim*, Injun Hwang, keewon Kim, and Sunae Seo
Samsung Advanced Institue of Technolog(SAIT), 1Semiconductor Devices Laboratory, Samsung Advanced Institute of Technology (SAIT), Mt. 14-1, Nongseo-dong, Giheung-gu, Yongin-si, Gyeonggi-do, 446-712, Korea
*Corresponding author: Kwang-Seok Kim, e-mail: stone99.kim@samsung.com

Spin transfer torque (STT) MRAM has been intensively studied and developed as a most promising next-generation nonvolatile memory because of its low power consumption, nano-second operation speed and excellent scalability.

In this presentation, current-induced magnetization switching will be demonstrated on sub-100nm magnetic tunnel junction cells, which are fabricated on 8 inch wafers by using E-beam lithography technology. Negative E-beam resist was used as a protective mask during ion beam etching (IBE) process for the patterning of MTJ cells. Chemical mechanical polish (CMP) and following E-bean resist ashing were conducted to make electrical contact through MTJs. Finally, top electrodes were metalized by utilizing metal deposition and reactive ion etch (RIE) procedure. The TEM image of the fabricated structure was shown in Fig. 1.

Statistical characterization for the switching current, thermal retention, and breakdown of fabricated MTJ cells will be presented.

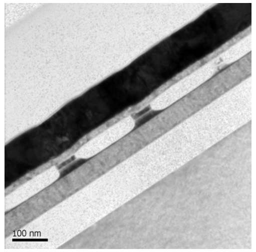

Fig. 1. TEM image of MTJ cells.