

Anomalous Exchange Bias of the Bottom NiFe layer in NiFe/FeMn/Al/NiFe

S. M. Yoon, J. J. Lim, Y. W. Lee, C. G. Kim and C. O. Kim*

[†] Department of Materials Science & Engineering, Chungnam National University, Daejeon, 305-764, Korea

*Corresponding author: e-mail: magkim@cnu.ac.kr, Phone: +82 42 821 6229, Fax: +82 42 822 6272

Many of the spin valve multilayer structures with FeMn as antiferromagnetic layer consist of a NiFe/FeMn/NiFe trilayer where the bottom NiFe layer is the seed layer to facilitate the growth of (111) γ -FeMn antiferromagnetic phase and the top NiFe layer forms the pinned layer¹.

In this study, exchange bias of bottom NiFe layer has been investigated as functions of thicknesses of top NiFe and Al in NiFe(3nm)/FeMn(8nm)/Al(t)/NiFe(t), prepared by rf magnetron sputtering, where NiFe and Al thicknesses were varied from 3 to 24 nm, from 0.3 to 2 nm, respectively. MH-loop was measured by vibration sample magnetometer (VSM). XRD patterns indicate the prominent (111) texture. Two hysteresis loops are corresponded to bottom and top layers, similar to reported loops in spin valve structure. The exchange bias of top NiFe layer is negligible when Al thicknesses in larger than 0.3 nm. As top NiFe thicknesses increases with Al thickness of 1nm, the exchange bias of bottom layer increases from 21.22 Oe to 228.82 Oe for NiFe thickness of 12 nm, but then decreases with NiFe thickness. Exchange bias of 69.78 Oe also increases to 228 Oe with Al thickness up to 1 nm, but decreases with further increase of Al thickness. Exchange bias of bottom NiFe could be induced by the interfacial coupling between bottom NiFe and FeMn. But those coupling are strongly dependent on the Al and top NiFe thicknesses, revealing anomalous character in exchange bias of bottom NiFe layer.

References

- [1] L. Ritchie, X. Liu, S. Ingvarsson, G. Xiao, Jun Du, and J. Q. Xiao, J.Magn. Magn. Mater., 247, 187 (2002)