

FeCo-NOL magnetism and exchange coupling in specular spin-valves

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The nano-oxide layer (NOL) in a specular spin-valve (SPSV) multilayer is fairly effective to enhance the MR ratio[1],[2], leading to the advanced CIP (current into the plane) configuration devices. It has been reported that the ion-assisted oxidation (IAO) process forms a thermally stable NOL[1]. Moreover, twisted coupling through the NOL was observed for the Fe₅₀Co₅₀ NOL by the IAO for higher than 800L oxygen exposures, which is not observed for the lower oxygen exposures. However, the main reason for the twisted coupling is still not clear because the structure and magnetism of NOL are unknown. Uncovering and understanding of the NOL structure and magnetism in a SPSV multilayer is great interesting from the view point of the specularity of the electron and the magnetic exchange coupling. In this paper, we investigated the dependence of the magnetic properties on temperature for the NOL(Fe₅₀Co₅₀-IAO) in the SPSV system by the precise measurement of magnetization process from low to high temperature.

The typical design of the SPSV sample was substrate(Si)/underlayer/PtMn/CoFe/Fe₅₀Co₅₀-IAO/CoFe/Cu/CoFe/Cu/Ta. The thickness of Fe₅₀Co₅₀ was 1 nm. Fig.1 shows the magnetization curves of SPSV with Fe₅₀Co₅₀-NOL (IAO 800L) at R.T. and 77K. The expansion of the hysteresis loop in the negative(pinned) field is observed at 77K. This result might suggest that the twisted exchange coupling energy through the NOL increases at low temperature. To confirm the origin of the twisted coupling, the detailed analyses of the temperature dependence of magnetization curve for the NOL samples with various oxygen exposures will be discussed.

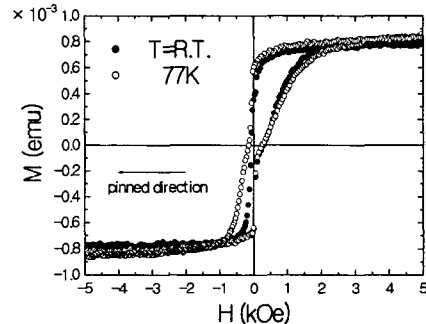


Fig.1. Magnetization curves of SPSV with Fe₅₀Co₅₀-NOL (IAO 800L) at R.T. and 77K.

References

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