Free layer stabilized structure of spin valve with antiferromagnet through a non-magnetic spacer layer.

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According to increasing areal density of a hard disk drive, a track width of their read head have been demanded the reduction of the size. Recently, size of the track width should be smaller than 200 nm at the areal density of 100 Gb/in^2[1]. It is important for the read head sensor to get a higher signal to noise ratio(SNR) as decreasing read track width. The hard magnet which is located both side of a spin valve film, is used to stabilize the free layer of the film. However, the hard magnet reproduce strong field at near the both side of the spin valve film resulting decrease SNR. Recently, improved technology for the free layer stabilization has been introduced as self-stablized free layer using exchange field by antiferromagnet in top of the free layer[1].

In this study, free layer stabilized structure of spin valve film with antiferromagnet through a non-magnetic spacer layer have been studied. Especially, the strength of exchange field between antiferromagnet and free layer was investigated as a function of thickness of various non-magnetic spacer layer. The spin valve films of Ta/NiFe/PtMn/CoFe/Cu/CoFe/NiFe/spacer/IrMn were fabricated by magnetron sputtering on thermally oxidized Si(100) wafer. The spacer layers were adapted Cu, Ta and their oxide layer. The magnetization of both antiferromagnet(IrMn and PtMn) was aligned perpendicularly by different annealing temperature and direction. The exchange field and coercivity were measured using by vibrating sample magnetometer(VSM). Magnetoresistance(MR) properties also were measured by conventional four probe method at room temperature. The exchange field strength shows decrease as increasing thickness of spacer layers as expected. The Cu spacer layer contributes to increase of MR ratio due to spin filter effect. The oxide layer plays a role of specular layer affecting increase of MR ratio. The free layer stabilization was also discussed by the result of MR values.

References

[1] Jeffrey R. et al., IEEE Trans. Magn., 38(5), 2286 (2002).