Micromagnetics Modeling of Single Pole Head for Double layered Perpendicular Media

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For the high-density magnetic recording above 100 Gb/in^2, double layered perpendicular media with recording layer of high Ku materials and soft underlayer (SUL) have been studied extensively by simulation tools as well as by experiments. However, especially for the part of single pole writing head, modeling has been performed by finite element method (FEM) in many cases. In this paper, to include total magnetic modeling and realistic head field for magnetic recording, the magnetic dynamics of a single pole head was obtained by micromagnetics modeling. Previously, we have shown the SNR is related to head field rise time [1]. The head field rise is a function of magnetic dynamics of single pole head, thus it is meaningful to survey the effect of current rise time, eddy current.

The single pole tip part has width of 60 nm, thickness of 160 nm, throat height of 200 nm and Bs of 2.1 T. The SUL was located 30 nm apart from ABS of pole tip and assumed to have thickness of 70nm and Bs of 2.1 T. In this calculation, the damping constant (α) was also varied from 0.1 to 0.01, because the magnetic dynamics is also a function of material's damping constant.

We have calculated magnetization switching and head field rise for different current rise times such as 0 ns, 0.4 ns and 0.8 ns. In the case of alpha = 0.01, when the current changes abruptly with no current rise time, the writing field shows poor characteristics (Fig.1a). The effect of eddy current is shown in Fig.2a. The magnetic field from eddy current degrades the switching of magnetic writing pole.

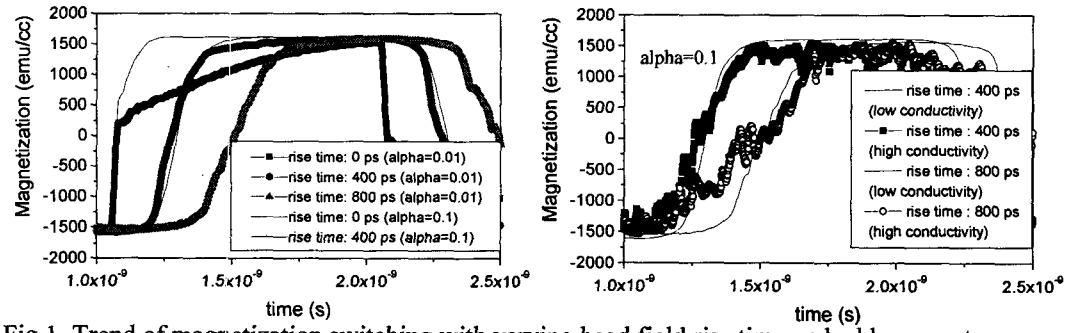

Fig.1. Trend of magnetization switching with varying head field rise time and eddy current.

References

[1] Y. W. Tahk, S. Y. Hong, D.H. Hong, S.C. Lee, H. J. Lee and T. D. Lee, Transition Noise Characteristics of PMR Media with the synthetic antiferromagnetic coupled SUL, 9th Joint MMM-Intermag, submitted.