IMPACT OF DAMPING CONSTANT IN HEAT-ASSISTED MAGNETIC RECORDING

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I. INTRODUCTION

We have already proposed a new model calculation [1, 2] for heat-assisted magnetic recording using the grain magnetization reversal probability and the attempt period, whose inverse is the attempt frequency f_0. f_0 is a function of the damping constant α [3], and α is also a function of temperature [4, 5]. Therefore, although knowledge of α at the writing temperature is necessary, it is unknown.

In this study, we calculate the bit error rate for α = 0.1 and 0.01 using our new model calculation, and discuss the results for various thermal gradients and linear velocities.

II. RESULTS

The new model calculation can obtain the bit error rate as a function of the writing field H_w. The bit error rates in this study are useful only in a comparison. Figure 1 shows the dependence of the minimum bit error rate (bER) on the thermal gradient for α = 0.1 and 0.01 within $H_w \leq$ 10 kOe where the linear velocity v = 10 m/s. When α = 0.1, the bER can be reduced as the thermal gradient increases since erasure-after-write can be suppressed. On the other hand, when α = 0.01, the bER becomes rather worse as the thermal gradient increases. Since the attempt period is long and the attempt number during writing is small for α = 0.01, the chance for writing decreases. The medium becomes cool before writing as the thermal gradient increases, and write-error increases. The coercivity becomes very high before writing, and a higher writing field H_w > 10 kOe becomes necessary. We can consider writing slowly by reducing the linear velocity to reduce write-error since the writing chance increases. As expected, the bER can be reduced as the linear velocity decreases as shown in Fig. 2. The damping constant at the writing temperature is a very important parameter.

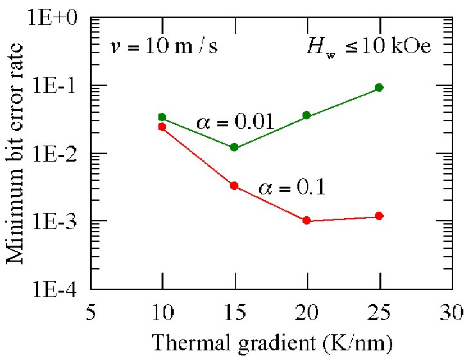

Fig. 1 Dependence of minimum bit error rate on thermal gradient for α = 0.1 and 0.01.

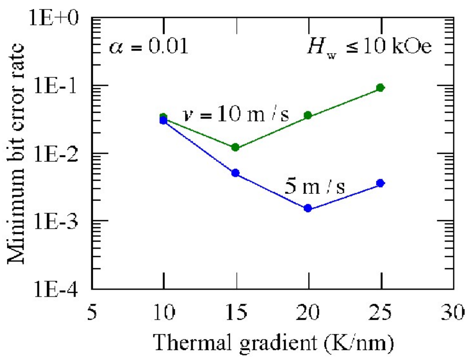

Fig. 2 Dependence of minimum bit error rate on thermal gradient for v = 5 and 10 m/s.

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REFERENCES

1) T. Kobayashi, F. Inukai, K. Enomoto and Y. Fujiwara, *J. Magn. Soc. Jpn*., 41(1) 1-9, (2017).
2) T. Kobayashi, Y. Nakatani, F. Inukai, K. Enomoto and Y. Fujiwara, *J. Magn. Soc. Jpn*., 41(3) 52-57, (2017).
3) Y. Nakatani, Y. Uesaka, N. Hayashi and H. Fukushima, *J. Magn. Magn. Mat*., 168 347-351, (1997).
4) T. Kobayashi, H. Hayashi, Y. Fujiwara and S. Shiomi, *IEEE. Trans. Magn*., 41(10) 2848-2850, (2005).
5) C. D. Stanciu *et al*., *Phys. Rev. B*, 73 220402(R), (2006).

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