Workshop III

Progress in Perpendicular Recording Heads

Tetsuya Roppongi
HDD Head Business Division, TDK Corporation,
543 Otai, Saku-shi, Nagano 385-8555, Japan

Introduction

The perpendicular magnetic recording system is a promising technology candidate to achieve higher recording density and the development is progressing for the practical implementation for HDD. In this presentation, our recent work on perpendicular recording heads is described, then a monopole writer as a conventional design and a shielded-pole writer as an improved design are reviewed. Shielded-pole heads were fabricated and their performance was evaluated.

Challenge of Perpendicular Recording Heads

The key issues to be solved in perpendicular recording with media with soft magnetic underlayer (SUL) are signal-to-noise-ratio (SNR), skew sensitivity in writing, wide area track erasure (WATE), pole erasure and external field robustness. In our shielded-pole writers, a trailing write-shield is successfully formed on a write pole with narrow write gap. And the write-shield needs to be designed so as to minimize the degradation of write-ability. Shielded-pole writers can improve the recording resolution and SNR, as a result, the byte-error-rate (BER) is much better than monopole writers. Because shielded-pole writers can increase the write field gradient and reduce side fringe [1]. A write pole for perpendicular magnetic recording needs to have trapezoid shape to reduce side writing at skew. The shielded-pole heads with around 130 nm wide trapezoid pole showed good write-ability for media with coercivity of 4600 Oe and the BER performance appears promising for extending the areal density progression, over 150Gbpsi. It was already confirmed by 747 curve that 170Gbpsi was achieved even under the flying height of 12nm. Pole erasure, which is observed as a write instability in a repeated read-write operation, can be suppressed by the pole-tip dimensions [2] and the pole material improvement to get appropriate domain structure. That's because the remanent magnetization of the write pole is reduced enough. The influence of the material properties and the domain structure of the writer yoke on pole erasure was investigated [3]. One of the causes of pole erasure is due to the induced magnetic anisotropy in the write pole-tip region by the magnetoelastic effect [4]. Even a mono-layered pole structure enabled pole erasure suppression. WATE was solved by the design integration of head and media. Due to reducing the external field sensitivity by head structure design optimization, good robustness to reduce the influence of external field was accomplished.

References

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