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Heat Assisted Magnetic Recording (HAMR) Head based on Thin Film Grating Structure with the Surface Plasmon Enhancement

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For the realization of the high density magnetic recording, it is necessary to overcome the superparamagnetic limit of magnetic media. The heat assisted magnetic recording (HAMR) is considered as the best candidate, which is based on the instant reduction of medium coercivity by the local laser heating during magnetic writing. To realize this HAMR head, it is required to consider the fabrication method to be integrated with the conventional magnetic head as well as the optimized design of optical delivery system using near-field optics. For satisfying both requirements, new HAMR head is proposed with the grating structure of thin film as shown in Fig 1. The metal grating structure can be formed easily on the Al_2O_3-TiC substrate using the metal deposition and photolithographic processing. The incident light will be guided to the nano-slit aperture which is formed through the metal grating with an aid of dielectric waveguide. The final surface of metal grating is planed using the dielectric deposition and chemical-mechanical processing for the next general process of magnetic head. Since new grating structure has an advantage to be integrated easily with the current magnetic head, this HAMR head can be applied to the high density magnetic recording head.

In this paper, the design concept of new HAMR head will be discussed with the FDTD simulation results with the focus on the fabrication process and the near-field optical enhancement by the surface plasmon polariton (SPP). From the FDTD simulation, it was confirmed that new head structure can provide the better optical throughput and smaller beam size. Actually, the peak intensity through the metal grating increases about 5 times with 30% smaller beam size than that of metal structure without a grating. Further simulation continues to find the optimum structure of the metal grating and dielectric layer to understand the light-matter interaction between them. More details will be discussed in the presentation.

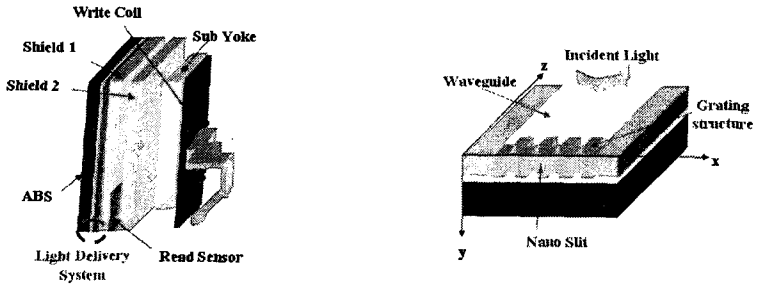

Fig. 1. Concept of new HAMR head

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A novel periodic disturbance observer design for hard disk drives

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In order to minimize effect of disturbances for the control of a complex dynamic system, cancellation of the disturbances through assistance of an observer is one of the most popularstrategies. Especially for hard disk drives where periodic disturbances are dominating, usage of those observers is common in modern hard disk drive servo designs. If a direct attempt to yield an inverse model for the observer construction is undertaken, an intricate design process should be employed. Adopting a filter also known as "Q-Filter" and adjusting its parameters with a complicated labour intensive process might be a typical example of the disturbance observer design. In the present work, a new observer design that employs Fourier coefficients based on frequency domain formulations is introduced. The presented method outperforms the conventional approaches for the cases of periodic disturbance dominated problems such as rotational machineries. Besides frequency selectivity of the introduced method benefits to improve the overall servo performance.

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