

A New Magneto Optical Card Storage System^{*}

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Abstract With no preformatted servo groove structure and simple linear moving instead of conventional disc rotation, a new erasable magneto optical card (MOC) is presented. Its data are written in tracks which are parallel to the width of the card. It possesses the advantages of MO disc erasability and optical card portability. As the defocus tolerance of $\pm 10\mu\text{m}$ for focus servo system is set up, the MOC storage system is low-cost and has a good potential markets in medium capacity storage fields.

Key words magneto optical card; defocus tolerance; focus servo storage system

As the industrialized nations of the world move further into the information age, the storage and distribution of information become more important. Advanced magneto optical storage technology is developed rapidly in the information memory technological fields. It possesses high reliable, high data density, large storage capacity, long lifetime, erasability and rewritability. Its erasable times are more than one million, and the price of unit data byte is low. Although close to strong magnetic field, its recording information is still reliable. MO disc storage technology, as the most wide application of MO storage technology, has been widely used in the large scale information storage fields.

However, in MO disc storage system, the needs of high precision mechanical and optical configuration, precision servo system, and the needs of precision preformatted servo groove structure before data written in MO disc, have made its storage system very expensive. In medium capacity fields, optical memory card which has the advantage of portability and low-cost, has been used in many aspects, but its unerasable property limits its use. In low capacity fields, erasable integrated circuit card and magnetic strip card has been developed^[1], but the low capacity limits its application fields.

For these reasons, we develop a new type of magneto optical card and its storage system. It possesses the advantages of MO storage technology and optical card portability, and it is low-cost. The detailed information^[2] comparison is shown in Table 1.

1 Structure of MO Card and Its Principle

The standard card sizes is: $54\text{mm} \times 85.5\text{mm}$, the effective recording area is $35\text{mm} \times 70\text{mm}$, the information unit is taken up $3\mu\text{m} \times 10\mu\text{m}$. According to this, the MO card capacity is about 10 MB. The unrecorded MO card need not contain a preformatted servo groove structure. Data are written in tracks that run parallel to the width of the card. A set of tracks constitutes a

block (stripe), which is the unit for one transaction, 1 kB capacity for user. It is possible to assign information of a specific classification to different stripes.

Table 1 Comparison of all kinds of memory cards

Card	Mag. card	IC card	Optical card	MO card
Sizes /mm ²	54× 85.5	54× 85.5	54× 85.5	54× 85.5
Capacity /B	200	8 k	2 M~ 8 M	10 M~ 20 M
Writing	Magnetic	Mag. /Ele.	Batch process	Laser
Reading	Magnetic	Mag. /Ele.	Laser	Laser
Erasability	Yes	Yes	No	Developing
Price /RMB	5~ 10 Yuan	200~ 500 Yuan	20~ 500 Yuan	50~ 100 Yuan

As the depth of focus is increased, the configuration of linear moving servo system is much more simple than the MO disc rotation system.

The speed of read/write is relatively low , which will decrease the laser power, and make the MOC storage system low-cost. The unrecorded MO card need no preformatted servo groove. It is pre-recording using photolithographic process which allows it to be duplicated in large quantities. The surface layer of the card is correspond to servo groove in MO disc storage system. The surface layer of the card is correspond to servo groove in MO disc storage system. The surface layer of the card is correspond to servo groove in MO disc storage system. The medium layer distribution is transparent substrate PC// Cr// SiN// MO// SiN// Al.

Specifications of MO card

Sizes 54.0 mm× 85.5 mm× 1.2 mm	Recording area 35 mm× 70 mm
Capacity: 10.0 MB	Track pitch: 10 μ m
Write speed 200 B/s	Read speed 1.6 kB/s
Interface: SCSI	Wavelength: 780 μ m
Obj. lens NA: 0.195	Spot diameter: 2.0 μ m
Depth of focus 10.0 μ m	

2 Design for MO Card Optical Head

An unfold magneto optical card read/write optical head is illustrated in Fig. 1. Optical head is a splitting structure. The reflector and object lens can be moved when a track is written/read, and the laser-spot scans the track to detect the amplitude of the reflected light. After a track writen/read, the MO card moves so that the next track can be done. If the movement of the card or the tracks are not parallel, the read out signal will be degraded. To correct this, servo system must adjust the object lens to focus laser beam on right information layer.

The optical head picks up signal by use of 3 beams principle. The main center beam 0 grade is used to read/write data,+ 1 and - 1 grades are used to follow the tracks of the information

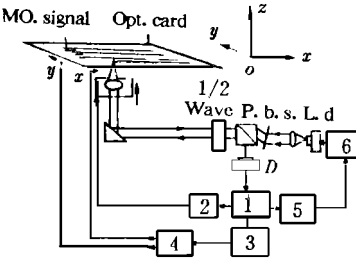


Fig. 1 Optical Head for MOC

tion. One track is constituted by $2\mu\text{ m}$ MO medium and $8\mu\text{ m}$ Cr. In order to utilize the power of the semiconductor efficaciously, a collimating lens has been optimum designed for read out signal. The influences of wavefront aberration (W_{20}, W_{31}, W_{40}) of objects lens to the read out signal (3 Dimension) have been received. In this case $W_{\lambda} \leq 0.05$, the Strehl intensity ratio is more than 0.8. So this optical head can be used to pick up MO signal^[3].

3 Read/write System SCSI Interface

The technology of MO card writing and reading is similar to the MO disc storage system. Using MO card as an external storage medium, the data transfer between card with computer(CPU) according to standard SCSI interface principle.

4 Conclusion

By using the MO card recording medium which does not suffer any surface deformation after the recording process, we obtain a defocus tolerance of $\pm 10\mu\text{ m}$ for focus servo system. Because of the increase of the focus depth and the laser beam size, the cost of the focus servo and the tracking system will be decreased greatly. This is at the expense of the decrease of the read/write speed. MO card with no preformatted servo groove structure and simple linear moving instead of conventional optical disc rotation has made its stroage system low-cost. With the increase of the stability, and the decrease of the cost, MO card read/write device as the book-sizes storage system will be widely used in many departments and fields furtherly.

References

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新型的磁光卡存储系统*
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【摘要】 提出了一种无预刻伺服槽结构的新型可擦式磁光卡,以简单的线性移动代替传统的光盘旋转方式,其数据记录于平行于磁光卡长的一侧的信道上.磁光卡既具有磁光盘的可擦重写性能又具有光卡的便携式特点.由于离焦容差为 $10\mu\text{ m}$ 的聚焦伺服系统已在实验中建立,决定了磁光卡存储系统成本低兼并且在中等容量存储领域具有极大的市场前景.

关 键 词 磁光卡; 离焦容差; 聚焦伺服; 存储系统
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