Studies of organic photonic high density read only memory (OP-ROM)

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ABSTRACT

Although recordable disk are rapidly developing, the mainstream in the market is still the read-only manufactures such as CD-ROM and DVD-ROM which have prerecorded information. How to enhance the storage density of read only memory is one of the hotspots in optical data storage. The authors put forward novel theory for read only memory. The novel theory takes little organic molecule as memory medium of read only memory, and the writing process is photon-mode, which is called organic photonic read only memory (OP-ROM). According to the novel theory, disks can be massively copied by exposure. Furthermore, because of diversity and modifiability of organic molecules, the storage density can be improved by multi-wavelength, multi-level and multi-layer.

Keywords: read only memory (ROM), massive copy, organic molecule, photo-mode, high density

1. INTRODUCTION

In recent years, optical disk storage technology and disk industry have obtained dramatically developments. However, the products in market matching computer are just read-only memories including CD-ROM and DVD-ROM, and recordable memories including CD(DVD)-R and CD(DVD)-RW. Although recordable disk are rapidly developing, the mainstream in the market is still the read-only manufactures such as CD-ROM and DVD-ROM which have prerecorded information.

The current read-only memories adopt mechanical mould pressing to realize information recording. In the process of mould pressing, it is necessary to prepare mould, and the technology of mould's preparation is complicated. The mould will be destroyed along with production, which affects the accuracy and sensitivity of recorded information. Furthermore, storage density is difficult to enhance because the improvement of density of the mechanical pits is very difficult.

The paper introduces a novel read-only-memory theory which uses organic molecules as memory medium, and depends on laser's photonic effect to record mould's information to disk substrate. The state A before exposure was colorless, and the state B after exposure was colorful. Information was written and read out by the color difference of A and B. Furthermore, information in mould could be whole recorded to the memory layer just by exposing. The theory is called one exposal full record (OEFR), and the disk is named organic photonic high density read only memory (OP-ROM).

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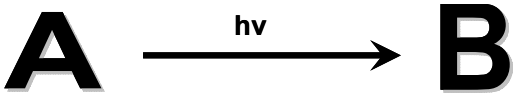

Scheme 1 Two states of memory medium of organic molecules

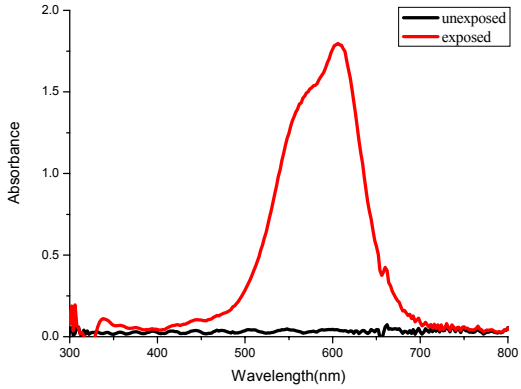

Figure 1 Absorption spectrum of memory medium

2. EXPERIMENT

2.1 Apparatus and materials

Steady absorption spectra were measured with a HP8452A diode array spectrophotometer. Photo-irradiation was carried out using a low-pressure mercury and xenon arc lamp.

All of the necessary chemicals were purchased from commercial sources. Solvents were purified by standard methods. Samples used for exposure was prepared by spin coating dimethyl benzene solvent containing polystyrene and organic molecules on glass substrate.

2.2 exposure equipment

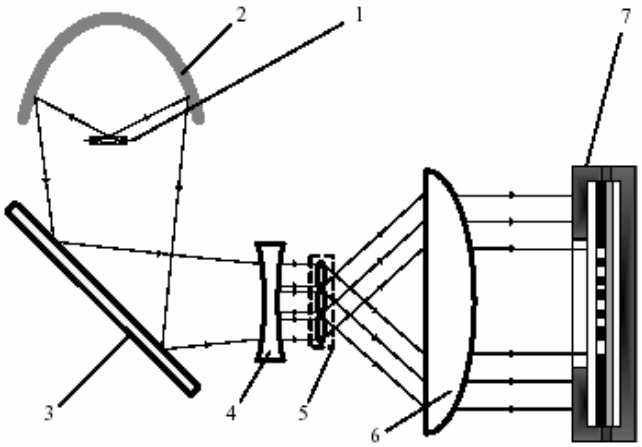

Figure 2 exposure system

1: near ultraviolet light source, 2: deep ellipsoidal reflector, 3: reflector, 4: negative lens for collimating, 5: fly's-eye lens, 6: lens for extender and collimating, 7: exposure holder.

3. RESULT AND DISCUSSION

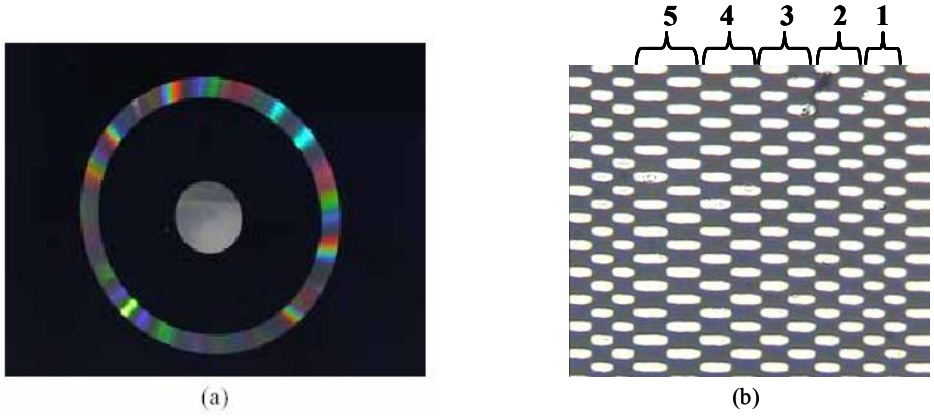

Figure 3 the mask (mould): (a) complete picture; (b) the size of record point (×2000)

In figure 3(b), the tangential sizes were five grades from 2.1um to 3.3um, radial size was 0.8um, and the track pitch was 1.6um.

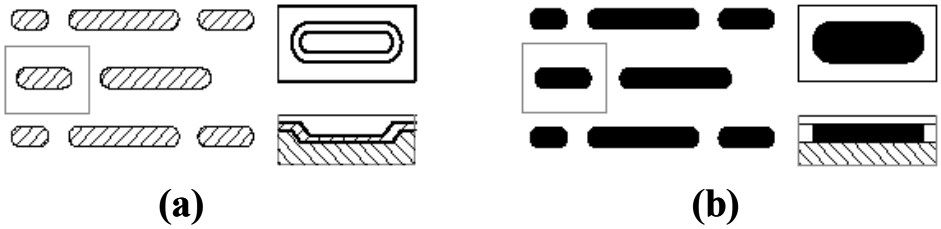

Figure 4 patterns of record points: (a) the existing disk-ROM; (b) the OP-ROM

The patterns of OP-ROM were absolutely different from the existing disk-ROM such as CD-ROM and DVD-ROM, and the description could be obtained from Figure 4. The existing disk-ROM's record point was three-dimensional, but the OP-ROM's was planar. The planar structure made it possible to improve the storage density by multi-layer or multi-level.

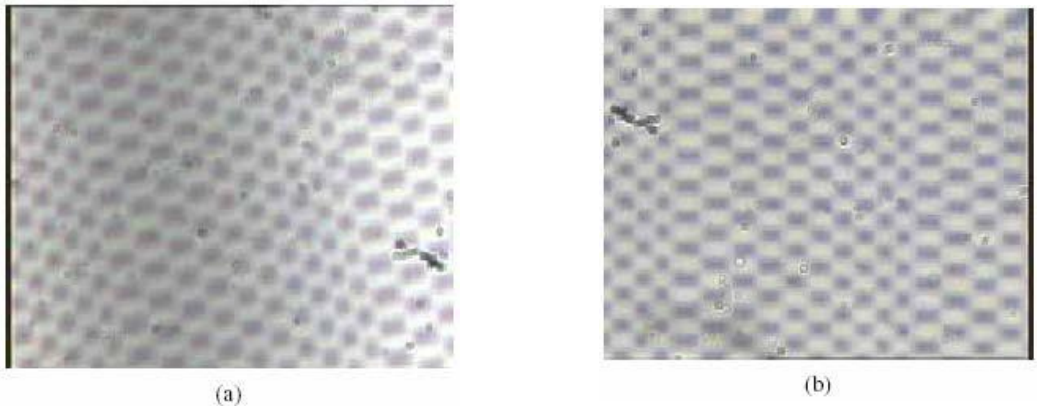

Figure 5 Results of exposure copy (×2000): (a) Exposure power was 12mW, and exposure time was 40s; (b) Exposure power was 75mW, and exposure time was 20s

Figure 5 expressed that the information of mask (mould) was accurately copied to the memory substrate. The five

tangential sizes were distinct and matched with that of mask, different tracks were clearly separated and the exposed region and unexposed region had a great contrast. Furthermore, along with the enhancing of exposure power and decreasing of exposure time, the reproducing result became better.

4. CONCLUSION

A novel read only memory, OP-ROM was introduced, and the experiment result showed the OP-ROM was reasonable and practicable. The storage theory of OP-ROM was absolutely different from the existing read only memory, which had its own advantages and avoided the disadvantages of the existing read only memory. The research of OP-ROM would break a new path to develop read only memory and made it was possible to further improve disks' data storage density after Blue-Ray Disk.

5. ACKNOWLEGEMENTS

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