Parallel Readout Technique of Roll-Type Multilayered Optical Memory

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ABSTRACT

We introduce one-dimensional parallel readout technique of a roll-type multilayered optical memory. Multiple signals can be detected simultaneously using a line-scanning confocal microscopy. We used groove-structured roll-type multilayered optical memory to demonstrate one-dimensional parallel readout. The groove-structures were imprinted by a digital versatile disc stamper. We could detect eleven signals from each groove-structured layer without crosstalk.

Key words: Multilayered optical memory, roll-type medium, parallel readout, line-scanning confocal microscopy

1. INTRODUCTION

Multilayered optical memory has been investigated for increasing a recording capacity. To fabricate multilayered optical memory more easily, we have developed roll-type optical advanced memory (RoCAM) [1]. RoCAM is a multilayered memory that has a cylinder structure. RoCAM is fabricated with a two-layered film, which is composed of a recording layer and an adhesive. Many layers can be fabricated by winding the two-layered film. RoCAM is possible to perform parallel recording and readout. Using a line-shape beam focused along the axis of the cylinder medium, multiple signals can be detected simultaneously. In this paper, we verify the possibility of one-dimensional (1D) parallel readout for RoCAM.

2. EXPERIMENTAL SETUP FOR ONE-DIMENSIONAL PARALLEL READOUT

We performed 1D parallel readout of a groove-structured RoCAM. Figure 1 shows the readout setup for 1D parallel readout. A helium-neon (He-Ne) laser beam of 633 nm wavelength was used as a light source. The laser light was focused with a cylindrical lens to form a line-shape spot. The scattered lights from the data were detected by a 1D CCD camera. A slit was placed in front of the detector to eliminate the scattered light outside of the focus plane. This is a similar configuration to a line-scanning confocal readout system. In this readout system, bit data were imaged by scanning of the recording medium. We defined the z-axis along the optical axis and the x-axis along the direction of the cylindrical lens. We used an oil immersion objective lens with a 1.3 numerical aperture (NA).

The groove-structured RoCAM was composed of a seat with an UV curable film and an adhesive. Groove structures were imprinted between the UV curable film and the adhesive interface by a digital versatile disc (DVD) stamper. The thicknesses of the UV curable film and the adhesive were 25 and 10 μm, respectively. The refractive indexes of the UV curable film and the adhesive with 633 nm wavelength were 1.51 and 1.47, respectively. A multilayer structure was fabricated by winding the seat onto a shaft. The number of layers was three.

3. RESULTS OF ONE-DIMENSIONAL PARALLEL READOUT

Figures 2(a)-2(c) show signals from the first, second, and third layer interfaces, respectively. We sequentially detected signals from each layer interface. From Figs. 2(a)-2(c), we could confirm multiple signals whose interval approximately corresponded to the groove pitch. The signal pitches in Figs. 2(a)-2(c) differed because we used the circular DVD stamper for the fabrication of grooves and cut it with a rectangular shape for winding on the shaft. As a result, we concluded that the detected signals were reflections from the groove. We could detect eleven signals simultaneously in Fig. 2(b). From these results, the data transfer rate of RoCAM can increase by over ten times that of the currently available system.

4. CONCLUSION

We demonstrated 1D parallel readout of a groove-structured RoCAM. Using line-scanning confocal microscopy, multiple signals can be detected without crosstalk. The number of signals that we could detect simultaneously was eleven. From these results, the data transfer rate of RoCAM can increase by over ten times that of the currently available system.

REFERENCES

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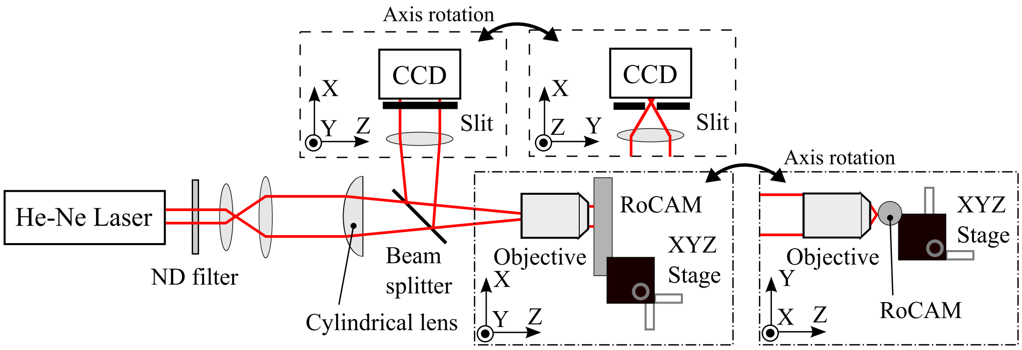

Fig. 1. Optical setup for one-dimensional parallel readout of RoCAM.

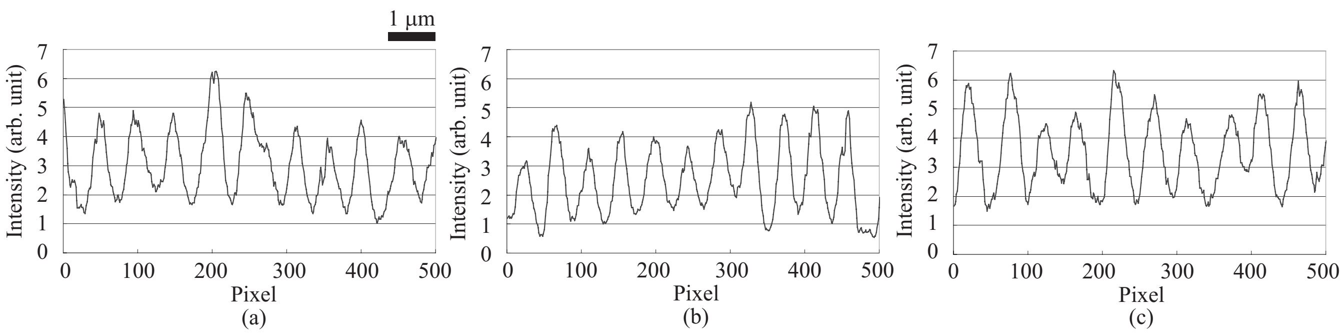

Fig. 2. One-dimensional parallel readout results of groove-structured RoCAM:
(a) signals from first layer interface, (b) signals from second layer interface, and (c) signals from third layer interface.

Biographies

Masatoshi Tsuji received B.E. and M.E. degrees in Engineering from Shizuoka University, Japan in 2007 and 2009, respectively. Since April 2009, he entered Ph.D. course of the Department of Nanovision Technology from Shizuoka University, Japan. Since April 2010, he has been research fellow of the Japan Society for the Promotion of Science. He won the best student paper award at International Symposium on Optical Memory (ISOM) in 2009 and the best academic paper award at ISOM in 2010. His current research activities are the study of multilayered optical memories.