# SUMMARY OF Ph.D. DISSERTATION

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Title

Study on larger capacity optical memory using wavelength multiplexing


Abstract

Optical memory is now being used in the home because it is non-contact and because it offers random accessibility and long archival life. Broadcast stations also are now starting to use it for the same reasons. However, the capacity and data-transfer rate are insufficient. Ultra HDTV is now being studied, and it requires larger capacity and a higher data-transfer-rate.

Holographic memory is feasible for these requirements because data can be recorded depending on the film thickness. However, the relationship between film thickness and data capacity is not linear, and a capacity limit exists.

This paper describes a wavelength-multiplexed multilayer type of holographic recording. Each recording layer has different wavelength characteristics. This memory changes ions, which are the photorefractive center, to enable a wavelength multiplexed. Also, the fabrication method for oxide film, the control of the crystal phase, characteristic dependency on substation ions, and the wavelength dependence on absorption are shown. Furthermore, this memory will enable 2.8 TB data capacity in a CD-sized disc.

Section one describes the background and purpose of this study.

Section two describes the fundamental investigation and fabrication method of the recording media. Rare earth iron garnets were used as the recording media. The fabrication conditions using laser ablation are explained. Moreover, we found that Fe and Co ions were sufficiently photorefractive enough to be used with our media.

Section three discusses the laser annealing method, which makes good quality crystals.

Three-dimensional transient thermal simulations and a crystallization calculation were conducted for the phase change material. After that, these methods were applied to rare earth iron garnet, and the crystallization conditions were clarified.

Section four discusses the recording and reproduction method for this media.

A stable writing method independent of the wavelength and multiplexing method with low cross talk for each layer were described. We clarified that both problems could be settled using adaptive control of the laser phase.

Section five summarizes the study and describes problems needing to be solved in future work.

This study presents new wavelength multiplexing method, which improves the capacity of optical memory.