Shimura Lab.

[Volume Holographic Memory]

Department of Fundamental Engineering

http://qopt.iis.u-tokyo.ac.jp

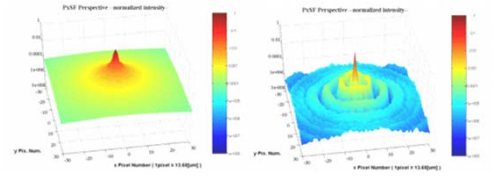
Applied Nonlinear Optics

Volume Holographic Memory

Volume holographic memory (VHM) is a high-density optical data storage system utilizing the principles of holography. The information is stored as a volume hologram and retrieved through the holographic reconstruction process. The VHM has a completely different recording system compared with the other conventional optical recording systems, like a DVD or Blu-ray. For example, thousands of holograms can be multiplexed in the same 1-cm^3 volume, and lots of data bits are simultaneously retrieved through the two-dimensional image reconstruction.

In our laboratory, we theoretically investigate the reconstruction process in the VHM systems to increase the signal to noise ratio and the storage density. Furthermore, we develop novel recording materials for realizing a rewritable VHM system. A few examples of our studies are listed below.

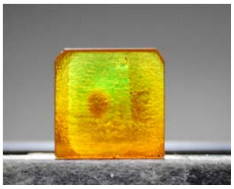
Theoretical analysis of the collinear holographic memory



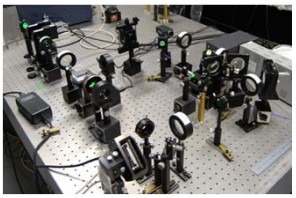
Collinear holographic memory is a quite unique system compared to other conventional holographic memory systems. It has significant advantages, such as a uniform shift selectivity and fairly large tolerances. We theoretically investigated the noise characteristics in collinear holographic memory, and estimated the system limit of the storage density.

Development of holographic recording materials

Photopolymer is currently the most promising recording material owing to its high recording sensitivity and large dynamic range. However, it is usually used as a write-once recording medium because the refractive index change is induced through the irreversible process. In order to realize a rewritable holographic memory, we develop novel rewritable materials, such as a reversible photopolymer and nonvolatile photorefractive crystals and evaluate their recording properties.



Nondestructive reconstruction of volume hologram



Unintended erasure of recorded holograms during readout has been the main obstacle to rewritable holographic memories. Recently, we proposed a new nondestructive readout method utilizing a polychromatic light. It enables us to retrieve the stored information at a longer wavelength outside the sensitive spectral region of the recording media. We demonstrated this method experimentally and developed the theory of holographic reconstruction with polychromatic light.