International Journal of Research

International Journal of Research (IJR)

e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 4, April 2015

Available at http://internationaljournalofresearch.org

Study of 3d Optical Data Storage

Shashikala Khandey[1]; Ankit Naik[2]& Purushottam Patel[3]

Student,CSE, Kirodimal Institute of Technology, Raigarh,India[1]

Lecturer CSE, Kirodimal Institute of Technology, Raigarh,India[2]

HOD CSE, Kirodimal Institute of Technology, Raigarh,India[3]

Abstract:

High (-1Tb/cm3) capacity 3Doptical data storage systems based on two photon excitation were evaluated. Previously proposed systems were shown to suffer from low I/O bandwidth rates. We propose a new serially addressed system based on hick storage layer optical disc format and acousto-optic addressing that can combine1TB/disc capacity wit100Mb/s1/0 band widths. For replacement of the bulky Ti: Sapphire laser considered before a compact fiber laser is recommended as light source. Optical Data Storage refers to store and retrieval of data in optical manner. Large volume of data is stored with some pattern and retrieves the same by focusing light or laser on the transmitted medium. A twist to this concept is "3D Optical Data Storage"

Keywords:

Volume holographic data storage; read-write holographic data storage; phase {conjugate readout; non-linear signal processing

I. INTRODUCTION

Cell 3D optical data storage is the term given to any form of opticaldata storage in which information can be recorded and/or read with three-dimensionalresolution (as opposed to the two-dimensional resolution afforded, This innovation has the potential to provide petabyte-level mass storage on DVD-sized discs (120mm). Data recording and readback are achieved by focusing lasers within the medium. However, because of the volumetric nature of the data structure, the laser light must travel through other data points before it reaches the point where reading or recording is desired. Therefore, some kind of nonlinearity is required to ensure that these other data points do not interfere with the addressing of the desired point.No commercial product based on 3D optical data storage has yet arrived on the mass market, although several companies are actively developing the technology and claim that it may become available soon. [1][2]

Fig 2. Detail View of Written Data on Medium

A wide range of physical phenomena for data reading and recording have been investigated, large numbers of chemical systems for the medium have been developed and evaluated, and extensive work has been carried out in solving the problems associated with the optical systems required for the reading and recording of data 3D optical data storage uses technology that allows more than100 layers to be written on a disc that looks like a traditional DVD. This creates an exponentially larger data capacity in the same amount of space. There are estimates that3D optical data discs will be able to store 5 terabytes of data or more.[5]

II. OPTICAL RECORDING TECHNOLOGY

Current optical data storage media, such as the CD and DVD store data as series of reflective marks on an internal surface of a disc. In order to increase storage capacity, it is possible for discs to hold two or more of these data layers, but their number is severely limited since the addressing laser interacts with every layer that it passes through on the way to and from the addressed layer.

International Journal of Research
International Journal of Research (IJR)
e-ISSN: 2348-6848, p- ISSN: 2348-795X Volume 2, Issue 4, April 2015
Available at http://internationaljournalofresearch.org

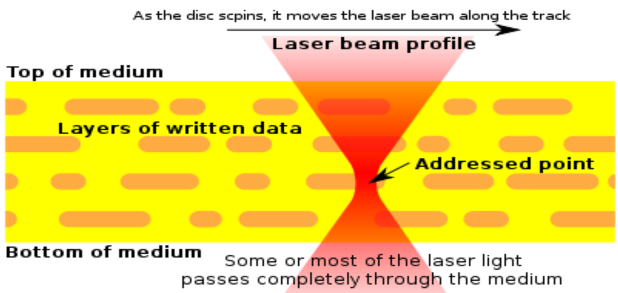

Fig 2. Detail View of Written Data on Medium

Current optical data storage media, such as the CD and DVD store data as a series of reflective marks on an internal surface of a disc. In order to increase storage capacity, it is possible for discs to hold two or even more of these data layers, but their number is severely limited since the addressing laser interacts with every layer that it passes through on the way to and from the addressed layer. These interactions cause noise that limits the technology to approximately 10 layers. 3D optical data storage methods circumvent this issue by using addressing methods where only the specifically addressed voxel (volumetric pixel) interacts substantially with the addressing light. This necessarily involves nonlinear data reading and writing methods, in particular nonlinear optics.

3D optical data storage is related to (and competes with) holographic data storage. Traditional examples of holographic storage do not address in the third dimension, and are therefore not strictly "3D", but more recently 3D holographic storage has been realized by the use of microholograms Layer-selection multilayer technology (where a multilayer disc has layers that can be individually activated e.g. electrically) is also closely related. As an example, a prototypical 3D optical data storage system may use a disc that looks much like a transparent DVD[1][2] The active part of 3D optical storage media is usually an organic poly-mere either doped or grafted with the photo chemically active species. Alternatively, crystalline and so-gel materials have been used. [5] to read the data back (in this example), a similar procedure is used except this time instead of causing a photochemical change in the media the laser causes fluorescence. This is achieved e.g. by using a lower laser power or a different laser wavelength. The intensity or wavelength of the fluorescence is different depending on whether the media has been written at that point, and so by measuring the emitted light the data is read.[5] The light therefore addresses a large number (possibly even 109) of molecules at any one time, so the medium acts as a homogeneous mass rather than a matrix structured by the positions of chromophoresss. Holographic data storage contains information using an optical inter ferenc pattern within a thick, photosensitive optical material.

III. PROCESSES FOR CREATING WRITTEN DATA

Data recording in a 3D optical storage medium requires that a change take place in the medium upon excitation. This change is generally a photochemical reaction of some sort, although other possibilities exist. Chemical reactions that have been investigated include photoisomerizations, photodecompositions and photobleaching, and polymerization initiation. Most investigated have been photochromic compounds, which include aazobenzenes, stilbenes[disambiguation needed], fulgides and diarylethenes. If the photochemical change is reversible, then rewritable data storage may be achieved, at least in principle. Also, multilevel recording, where data is written in "grayscale" rather than as "on" and "off" signals, is technically feasible.[`1][2]

IV. OPTICAL RECORDING TECHNOLOGY AND APPLICATIONS

Optical storage systems consist of a drive unit and a storage medium in a rotating disk form. In general the disks are pre-formatted using grooves and lands (tracks) to enable the positioning of an optical pick-up and recording head to access the information on the disk. Under the influence of a focused laser beam emanating from the optical head, information is recorded on the media as a change in the material characteristics, often using a thermally induced effect. To record a bit, a small spot is generated on the media modulating the phase, intensity, polarization, or reflectivity of a readout optical beam which is subsequently detected by a detector in the optical head. The disk media and the pick-up head are rotated and positioned through drive motors and servo systems controlling the position of the head with respect to data tracks on the disk. Additional peripheral electronics are used for control and data acquisition and encoding/decoding. Such a[1][2]Optical storage systems consist of a drive unit and a storage medium in a rotating disk form. In general the disks are pre-formatted using grooves and lands (tracks) to enable the positioning of an optical pick-up and recording head to access the information on the disk. Under the influence of a focused laser beam emanating from the optical head, information is recorded on the media as a change in the material characteristics. The disk media and the pick-up head are rotated and positioned through drive motors controlling the position of the head with respect to data tracks on the disk. Additional peripheral electronics are used for control and data acquisition and encoding/decoding.

As an example, a prototypical 3D optical data storage system may use a disk that looks much like a transparent DVD. The disc contains many layers of information, each at a different depth in the media and each consisting of a DVD-like spiral track. In order to record information on the disc a laser is brought to a focus at a particular depth in the media that corresponds to a particular information layer. When the laser is turned on it causes a photochemical change in the media. As the disc spins and the read/write head moves along a radius, the layer is written just as a DVD-R is written. The depth of the focus may then be changed and another entirely different layer of information written. The distance between layers may be 5 to 100 micrometers, allowing >100 layers of information to be stored on a single disc.[11] As an example, a prototypical 3D optical data storage system may use a disk that looks much like a transparent DVD. The disc contains many layers of information, each at a different depth in the media and each consisting of a DVD-like spiral track. In order to record information on the disc a laser is brought to a focus at a particular depth in the media that corresponds to a particular information layer. When the laser is turned on it causes a photochemical change in the media. As the disc spins and the read/write head moves along a radius, the layer is written just as a DVD-R is written. The depth of the focus may then be changed and another entirely different layer of information written. The distance between layers may be 5 to 100 micrometers, allowing >100 layers of information to be stored on a single disc.[2] be considered of genral computing application this will depend on the capacity and costperformermance that hart disk drive offerIn the future[6]

Three-dimensional optical storage:-

One of the reasons that computers have become increasingly important in daily life is because they unprecedented access to massive amounts of information. The decreasing cost of storing data and the increasing storage capacities of ever smaller devices have been key enablers of this revolution. Current storage needs are being met because improvements in conventional technologies such as magnetic hard disk drives, optical disks, and semiconductor memories| have been able to keep pace with the demand for greater and faster storage.[10]

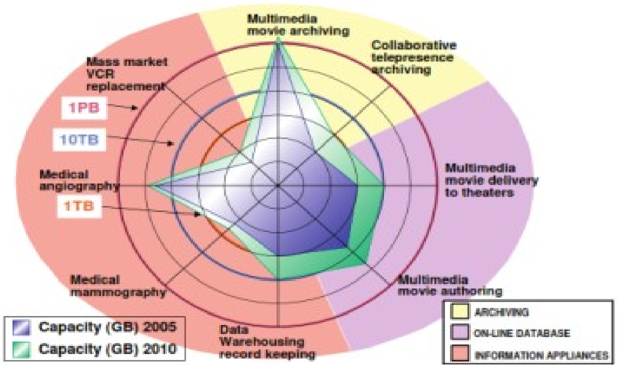

Fig 3 Capacity imposed by various applications by years 2005 and 2010

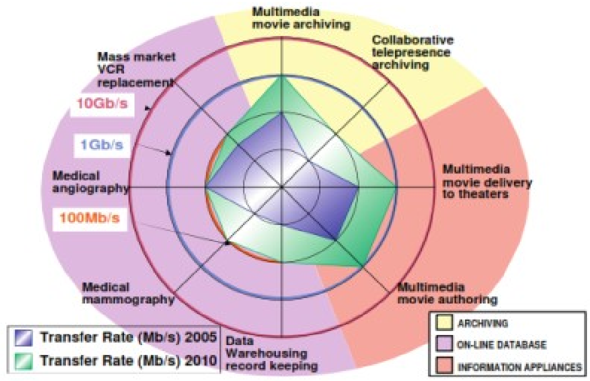

Fig 4Data Rate Requirements imposed by various applications by years 2005 and 2010

V. CONCLUSION

The evolutionary approaches that are based on current technologies have the potential to be forward compatible. Such as use of depth of focus and have

the lowest risk in terms of media, storage device and cost. However the benefits for potential density gains are also limited. When the key features of optical data storage – removability and inter changeability are to be retained . Optical storage will continue to evolve but it is only depend upon on both technical feasibility and commercial viability.[5] On the other hand, the revolutionary approaches promise much higher densities at substantially higher risk. Some of this risk arises because laboratory development tends to demonstrate features individually, avoiding ect.which only show up when performance spushedacrosstheboard [7]One of the reasons that computers have become increasingly important in daily life is because they over's unprecedented access to massive amounts of information. The decreasing cost of storing data and the increasing storage capacities
of ever smaller devices have been key enablers of this revolution. Current storage needs are being met because improvements in conventional technologies such as magnetic hard disk drives, optical disks, and semiconductor memories have been able to keep pace with the demand for greater and faster storage.[10]

REFERENCES

[1] A. B. Marchant. Optical Recording.Addison{Wesley, Massachusetts, 1990.

[2]IEEE Journal of selected topice in Quantum Electronics vol.4, no.5 September/October

[3]Wikipedia.

[4]Seminarsonly.

[5]Geoffrey w.sburr IBM Almaden Research center August 4,2003.

[6]Peter I.Richter,Em6ke L6rincz, Paul Koppa,Gibor Szarvas Department of Atomi PhysicTechnicalsUniversity of Budapest Budafoki ift 8, 1111 .Budapest,Hungary.

[7]Jinal H.Tailor volume:3 Issue:4 Apiral 2014 ISSN No 2277-8160.

[8]"Three-Dimensional Optical Data Storage Using Photochromic Materials" S. Kawata and Y. Kawata, Chem. Rev. 2000, 100, 1777.

[9] Paper 6653-10 presented at SPIE Optics and Photonics 2007, San Diego .
[10]http://phys.org/news/2010-10-scientists-hidden-3d-optical-storage.html

[11] D. A. Parthenopoulos and P. M. Rentzepis, Science 245, 843 | (1989).

[12] J. H. Strickler and W. W. Webb, Opt. Lett. 16, 1780 (1991); U.S.Patent #5,289,407 (1994).

[13]Y. Kawata, H. Ueki, Y. Hashimoto, and S. Kawata, Appl. Opt.34, 4105 (1995).

[14] H. Ueki, Y. Kawata, and S. Kawata, Appl. Opt. 35, 2457 (1996)

[15] J. Ihlemann, B. Wolff, and P. Simon, Appl. Phys. A 54, 363 (1992).