METHOD OF RECORDING DRIVE INFORMATION ON OPTICAL DISC AND OPTICAL DISC HAVING DRIVE INFORMATIONRecorded USING THE METHOD

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METHOD OF RECORDING DRIVE INFORMATION ON OPTICAL DISC
AND OPTICAL DISC HAVING DRIVE INFORMATION RECORDED
USING THE METHOD

Technical Field
The present invention relates to a method of recording drive
information on an optical disc and an optical disc on which drive
information is recorded using the method.

Background Art
In the case of a 4.7GB DVD-RAM, which allows data to be
recorded thereon or removed therefrom, drive information, which is used
after the optical disc is inserted into a drive, e.g., information on a drive
manufacturing company or a serial number, is recorded in a disc
identification zone of a lead-in zone where data can be rewritten.
However, since only two error correction codes (ECC) are assigned to
the disc identification zone, drive information cannot be recorded in the
disc identification zone if the two ECCs have defects and cannot be
used.

Accordingly, a HD-DVD, which has a capacity of over 23GB and
on which data can be rerecorded, is required to have a drive zone having
more than two physical clusters in the lead-in zone wherein drive
information must be recorded. FIG. 1 shows one embodiment of a
physical structure of the lead-in zone, which has a diameter longer than
a predetermined diameter from the center hole of the disc. The lead-in
zone includes a read-only zone 100 in which data is pre-recorded and a
rewritable zone 110 in which data can be rerecorded. The read only
region 100 includes control data which are related to the disc.

The rewritable zone 110 includes a test zone, a defect
management area (DMA) for removing and managing defects occurring
in the disc, a control data zone, an optimum power control (OPC) test
zone, and a buffer area.

Here, the rewritable zone 110 further includes a drive region where the drive information is recorded. The drive region is comprised of a plurality of physical clusters, each cluster comprising a plurality of data frames. In the drive region, information on the manufacturing company, a serial number, or the like are recorded. As described above, it is currently required a method of recording information in the drive region which is composed of a plurality of physical clusters.

Disclosure of the Invention

It is an object of the present invention to provide a method of recording information in a drive region composed of a plurality of clusters, by recording drive information in a set consisting of a plurality of consecutive and reliable physical clusters of the physical clusters in the drive region, and recording an address of the first reliable cluster in a disc definition structure DDS, thereby effectively recording drive information, and an optical disc in which drive information is recorded using the method.

It is another object of the present invention to provide a method of recording drive information by sequentially using consecutive and reliable physical clusters from the first cluster in a drive region where the drive information is recorded, and recording all addresses of the clusters in the DDS (Disc Definition Structure), thereby effectively recording the drive information, and an optical disc in which drive information is recorded by using the method.

Brief Description of the Drawings

The above objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 is shows a structure of a conventional lead-in area;
FIG. 2 is a view showing a drive region in which drive information is recorded according to a method of recording drive information according to a first embodiment of the present invention;

FIG. 3 is a view showing a DDS (Disc Definition Structure) in which drive information is recorded according to the method of recording drive information of the first embodiment of the present invention;

FIG. 4 shows of a structure of a drive region in which drive information is recorded according to a method of recording drive information according to a second embodiment of the present invention;

FIG. 5 is a view of one embodiment of recording drive information according to a method of recording drive information of the second embodiment of the present invention; and

FIG. 6 is a view of a part of a DDS in which drive information is recorded according to the method of recording drive information of the second embodiment of the present invention.

Best mode for carrying out the Invention

The present invention will now be described more fully with reference to the accompanying drawings, in which preferred embodiments of the invention are shown.

According to a method of recording drive information of the present invention, drive information is recorded consecutively or sequentially from the beginning of reliable clusters when an unreliable physical cluster is created due to consecutive or non-consecutive defects in some physical clusters of a drive region in which the drive information is recorded.

According to a first embodiment of the present invention, drive information is recorded in a set consisting of a reliable and consecutive plurality of clusters of the drive region. That is, the drive information is recorded in a set consisting of the reliable and consecutive plurality of
clusters except for any physical cluster which is damaged, defect, or unreliable starting, from the beginning of the drive region.

Referring to FIG. 2, a drive region 10, in which the drive information is recorded, includes n+1 numbers of physical clusters, 10-0, 10-1, 10-2, ..., 10-n. If, for example, the zero physical cluster 10-0 and the first physical cluster 10-1 are damaged, and the second cluster 10-2 and the third cluster 10-3 are reliable, original drive information and a copy of the drive information are respectively recorded in the set consisting of the second physical cluster 10-2 and the third physical cluster 10-3. Thus, the drive information is recorded in the consecutive physical clusters among available physical clusters. Preferably, the drive information may be recorded in a set consisting of two available physical clusters.

The drive region 10 can be included in other region but a user data area. Referring to FIG. 1, the lead-in area of the inner round of the disc track includes a read only region 100 and a rewritable region 110. The drive region 10 may be included in a predetermined area of the rewritable region 110, or in a predetermined area of a rewritable region (not shown) of a lead-out region of the outer round of the disc track. Although not shown in the figures, the lead-out area can also include the drive region, and the drive information can be recorded in a set consisting of a plurality of consecutive available physical clusters of such drive region.

According to the method of recording the drive information of the present embodiment, the addresses of a set of physical clusters, in which the original drive information and the copy of the drive information are recorded, are recorded and managed in a separate region other than the drive region. For example, the address of the first reliable physical cluster of a set of physical clusters, in which the drive information is recorded, is recorded in the region where information related to defect
managing is recorded. The region where information related to defect managing may be a defect managing area DMA as shown in FIG. 1.

FIG. 3 shows a disc definition structure DDS of the DMA. The address of the first reliable physical cluster of a set of physical clusters, in which the drive information is recorded, is recorded in a predetermined area of the DDS of the DMA. For example, the address may be recorded in an m-bites position 12 of a data frame. Here, the reliable physical cluster denotes a physical cluster in which data, that have undamaged and complete information and thus can be smoothly reproduced, are recorded. The address of the physical cluster can be recorded as a physical sector number PSN corresponding to each physical cluster.

For example, if both the physical cluster in which the original drive information is recorded and the physical cluster in which the copy drive information is recorded, are reliable, the address of the physical cluster, where the original drive information is recorded, is recorded. However, if the physical cluster where the original drive information is recorded is damaged and unreliable, and the physical cluster where the copy drive information is recorded, is reliable, the address of the physical cluster, where the copy drive information is recorded, is recorded in the DDS.

In addition, if the physical clusters where the original drive information and the copy drive information are reliable and thus the address of the physical cluster, where the original drive information is recorded, recorded in the DDS becomes damaged or defected during a use thereof, and thus becomes unreliable, the address of the physical cluster, where the copy of the drive information is recorded, is newly recorded in the DDS.

If the second physical cluster 10-2 and the third physical cluster 10-3 become damaged and unreliable, the original drive information and the copy drive information are recorded again in the next available physical clusters such as a fourth physical cluster and a fifth physical
cluster. Then, if it is determined that the fourth physical cluster is reliable, the address of the fourth physical cluster is recorded in the DDS. If it is determined that the fifth physical cluster is reliable, the address of the fifth physical cluster is newly recorded in the DDS.

As described above, the address of the first reliable physical cluster is recorded in the DDS and is updated as an address of the first reliable physical cluster all the time. Thus, the drive information which is reliable can be immediately reproduced without any delay.

An optical disc according to an embodiment of the present invention includes a drive region, in which the drive information is recorded, and the original drive information and the copied drive information are recorded in a set of consecutive available physical clusters.

The address of the first reliable physical cluster of the physical clusters where the original drive information and the copy of the drive information are respectively recorded can be recorded in a separate region other than the drive region. For example, the address may be recorded in the region where the information related to defect managing is recorded.

Here, the address of the first reliable physical cluster of the drive region denotes the address of the physical cluster which is a reliable physical cluster, the first from the beginning of the drive region. Therefore, if the first physical cluster from the beginning of a set of physical clusters is reliable among the two physical clusters where the drive information is recorded, the address of the first physical cluster from the front of a set of two physical clusters is recorded. If the second physical cluster from the front of a set of two physical clusters is reliable, the address of the second physical cluster from the beginning of a set of two physical clusters.

The method according to the first embodiment of the present invention is advantageous in that the drive information can be rapidly and
correctly reproduced by recording the address of the first physical cluster from the beginning of a set of physical clusters where the drive information is recorded.

Next, a method of recording the drive information according to a second embodiment will be described.

In this case, the drive information is sequentially recorded in the reliable physical clusters if defects occur in consecutive or non-consecutive physical clusters and the physical clusters are unreliable.

Here, the drive information can be sequentially recorded in a set consisting of a plurality of physical clusters as well as in each physical cluster.

Referring to FIG. 4, a drive region 20, in which the drive information is recorded, includes a plurality of physical clusters. According to an embodiment of the present invention, the same drive information is recorded in at least two physical clusters so as to provide against a case where the drive information, damaged or defected, is not available. Here, for convenience, the drive information is deemed to be recorded in two physical clusters.

For example, if a zero physical cluster 20-0 and a first physical cluster 20-1 are damaged, a second physical cluster 20-2 is reliable, a third physical cluster 20-3 is damaged and a fourth physical cluster 20-4 is reliable, the original valid drive information and the copy of the drive information are recorded in the second physical cluster 20-2 and the fourth physical cluster 20-4.

As described above, the drive information is recorded sequentially and selectively in the reliable physical clusters of the drive region. Preferably, the drive information may be recorded in a set consisting of two physical clusters. FIG. 4 shows the drive region of n physical clusters where the damaged and unreliable regions are presented by hatching. As shown in FIG. 4, if the zero physical cluster 20-0 and the
first physical cluster 20-1 are damaged and not available, the second physical cluster 20-2 is reliable, and the third physical cluster 20-3 is not available, the valid drive information of the original drive information and the copy of the drive information are recorded sequentially in the first reliable and available physical clusters.

That is, the valid drive information of the original drive information and the copy of the drive information are recorded in the second physical cluster 20-2 and the fourth physical cluster 20-4, respectively. Then, the original valid drive information and the copied drive information are recorded in the next pair of reliable physical clusters. In FIG. 5, a fifth physical cluster 20-5 and a sixth physical cluster 20-6 are unreliable and not available, and the drive information is recorded in a set consisting of the seventh physical cluster 20-7 and the eighth physical cluster 20-8. In FIG. 5, the set consisting of two physical clusters where the drive information is recorded is sequentially indicated by "0".

The drive region 20 can be included in other region but a user data area. Referring to FIG. 1, the lead-in area of the inner round of the disc track includes a read only region 100 and a rewritable region 110. The drive region 20 may be included in a predetermined area of the rewritable region 110, or in a predetermined area of a rewritable region (not shown) of a lead-out region of the outer round of the disc track. Although not shown in the figures, the lead-out area can also include the drive region, and the drive information can be recorded in a set consisting of a consecutive plurality of available physical clusters of the drive region.

According to the method of recording drive information of the present invention, the addresses of a set of physical clusters, in which the valid drive information and the copy of the drive information are recorded, are recorded and managed in a separate region other than the drive region. For example, the address of the first reliable physical cluster of a set of physical clusters, in which the drive information is
recorded, is recorded in the region where information related to defect managing is recorded. The region where information related to defect managing may be a defect managing area DMA of FIG. 1.

FIG. 6 shows the DDS of the DMA. An address 21 of the physical cluster in which the original valid drive information is recorded and an address 22 of the physical cluster in which the copy of the drive information is recorded, are recorded in a predetermined area of the DDS of the DMA. For example, the addresses can be recorded in an m-bites and an (m+1)-bites positions. Here, the address can be recorded as a physical sector number PSN corresponding to each physical cluster. As described above, since both the addresses 21 and 22 are recorded, at least one drive information can be used in recording and/or reproducing data. That is, when the data is recorded and/or reproduced, the drive information in the region, which the address of the region having the reliable drive information recorded in the DDS is recorded presents, can be used.

Industrial Applicability

According to the present invention, the drive information is recorded sequentially in the first set of the reliable and available physical clusters, the addresses of the physical clusters, in which the drive information is recorded, are recorded in the DDS, and the drive information can be recorded in at least one physical cluster of the set of reliable physical clusters.
What is claimed is:

1. A method of recording drive information, the method comprising:

   including a plurality of physical clusters in a drive region where disc drive information is recorded, and recording the drive information in a set consisting of a plurality of consecutive and available physical clusters; and

   recording an address of the first reliable physical cluster from the plurality of consecutive and available physical clusters, in a separate region other than the drive region.

2. The method of claim 1, wherein when the drive information is recorded in the available physical clusters, original drive information and a copy of the drive information are recorded in two consecutive available physical clusters.

3. The method of claim 1 or 2, wherein the address of the first reliable physical cluster from the plurality of consecutive and available physical clusters, is recorded in a region where information related to defect managing is recorded.

4. A method of recording drive information, the method comprising:

   including a plurality of physical clusters in a drive region in which disc drive information is recorded; and

   recording the drive information sequentially from the beginning of first reliable and available physical cluster of the plurality of physical clusters.

5. The method of claim 4, wherein the drive information is recorded sequentially in a set consisting of a plurality of sequential and
available physical clusters.

6. The method of claim 5, wherein when the drive information is recorded in the physical clusters, the original valid drive information and a copy of the drive information are recorded sequentially in two reliable and available physical clusters, respectively.

7. The method of one of claims 4 to 6, wherein the addresses of the available physical clusters, where the drive information is recorded, are recorded in a separate region other than the drive region.

8. The method of claim 7, wherein the addresses of the available physical cluster, where the drive information is recorded, are recorded in a region where information related to defect managing is recorded.

9. The method of claim 1 or 4, wherein the drive region is included in other region except for a user data area.

10. The method of claim 9, wherein the drive region is included in a rewritable region of a lead-in area having a read only region and the rewritable region.

11. An optical disc having a plurality of physical clusters and a drive region, where disc drive information is recorded, in the physical clusters, wherein the drive information is recorded in a set consisting of a plurality of consecutive and available physical clusters, and an address of a reliable physical cluster, which is first from the available physical clusters, is recorded in a separate region other than the drive region.
12. The optical disc of claim 11, wherein the drive information is recorded in the available physical clusters, original drive information and a copy of the drive information are recorded in two consecutive available physical clusters.

13. The optical disc of claim 11 or 12, wherein the address of the reliable physical cluster, which is the first physical cluster from the plurality of consecutive and available physical clusters, is recorded in a region where information related to defect managing is recorded.

14. An optical disc having a plurality of physical clusters and a drive region, where disc drive information is recorded, in the physical clusters, wherein the drive information is recorded sequentially in first of the reliable and available physical clusters of the plurality of physical clusters.

15. The optical disc of claim 14, wherein the drive information is recorded sequentially in a set consisting of a plurality of consecutive and available physical clusters.

16. The optical disc of claim 14 or 15, wherein when the drive information is recorded in the physical clusters, the original valid drive information and a copy of the drive information are recorded sequentially in two reliable and available physical clusters, respectively.

17. The optical disc of claim 14, wherein the addresses of the available physical clusters, where the drive information is recorded, are recorded in a separate region other than the drive region.

18. The optical disc of claim 11 or 14, wherein the drive region is included in other region except for a user data area.
19. The optical disc of claim 18, wherein the drive region is included in a rewritable region of a lead-in area including a read only region and the rewritable region.
<table>
<thead>
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<th>LEAD-IN AREA</th>
<th>READ-ONLY AREA</th>
<th>REWRITABLE AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>DESCRIPTION</td>
<td>PURPOSE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>DISC-RELATED CONTROL DATA</td>
<td>DEFECT MANAGING</td>
</tr>
<tr>
<td></td>
<td>FREQUENCY WOBBLE DMA DATA INFORMATION</td>
<td>OPC TESTING</td>
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<td></td>
<td>CONTROL DATA</td>
<td>DRIVE RELATED INFORMATION</td>
</tr>
<tr>
<td></td>
<td>DRIVING ZONE</td>
<td>BUFFER FOR DATA REGION</td>
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**FIG. 1**
FIG. 2

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<table>
<thead>
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<td>10-0</td>
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<td>10-1</td>
</tr>
<tr>
<td>10-2</td>
</tr>
<tr>
<td>10-3</td>
</tr>
<tr>
<td>...</td>
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<td>(N+1)th PHYSICAL CLUSTER</td>
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FIG. 3

<table>
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<th>DESCRIPTION</th>
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<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>m</td>
<td>ADDRESS OF RELIABLE PHYSICAL CLUSTER WHICH IS THE FIRST FROM THE BEGINNING OF DRIVE REGION</td>
</tr>
<tr>
<td>m+1</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td>...</td>
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</tbody>
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FIG. 4

BEGINNING OF DRIVE REGION

DAMAGED
20-0

DAMAGED
20-1

ORIGINAL VALID DRIVE INFORMATION
20-2

DAMAGED
20-3

COPY OF THE DRIVE INFORMATION
20-3

DAMAGED

(N+1)th PHYSICAL CLUSTER
20-n
**FIG. 6**

<table>
<thead>
<tr>
<th>BITE POSITION IN DATA FRAME</th>
<th>DESCRIPTION</th>
</tr>
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<tbody>
<tr>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>m</td>
<td>ADDRESS OF PHYSICAL CLUSTER WHERE VALID DRIVE INFORMATION IS RECORDED</td>
</tr>
<tr>
<td>m+1</td>
<td>ADDRESS OF PHYSICAL CLUSTER WHERE COPY OF THE DRIVE INFORMATION IS RECORDED</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>
**INTERNATIONAL SEARCH REPORT**

### A. CLASSIFICATION OF SUBJECT MATTER

**IPC7 G11B 7/007**

According to International Patent Classification (IPC) or to both national classification and IPC

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7 G11B 7/00-7/24, G11B 20/00-20/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, PAJ "DRIVE", "INFORMATION", "CLUSTER", "RECORD", "REPRODUC**"

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<tr>
<td>A</td>
<td>JP 03-59846 A (TOSHIBA CORP.) 14 MARCH 1991, see the whole document</td>
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<tr>
<td>A</td>
<td>US 5448433 A (INTEGRAL PERIPHERALS) 5 SEPTEMBER 1995, see the whole document</td>
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- * Special categories of cited documents:
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier application or patent but published on or after the international filing date
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  - "P" document published prior to the international filing date but later than the priority date claimed

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- **"&"** document member of the same patent family

- Date of the actual completion of the international search: 19 JUNE 2003 (19.06.2003)
- Date of mailing of the international search report: 19 JUNE 2003 (19.06.2003)

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