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TITLE OF THE INVENTION

OPTICAL RECORDING MEDIUM HAVING SECRECY OF RECORDED INFORMATION AND ERASE METHOD THEREFOR AND INFORMATION RECORDING/READING SYSTEM USING THE SAME

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an optical recording medium having secrecy of stored information, an erase method therefor, and an information system recording/reading therefor.

Discussion of the Background

Optical recording media are disc-shaped media capable of reading and recording information by optical devices. For example, Compact Discs (hereinafter referred to as CDs) such as a Compact Disc Digital Audio (CD-DA), a Compact Disc Read Only Memory (CD-ROM), a Compact Disc Recordable (CD-R), and a Compact Disc ReWritable (CD-RW), or large capacity optical recording media such as a Digital Video Disc Read Only Memory (DVD-ROM), a Digital Video Disc Recordable (DVD-R), and a Digital Video Disc ReWritable (DVD-RW) are well known.

Currently these media have become widely spread as the information recording/transmitting media. In particular, CD-RW media remarkably become wide spread as erasable/rewriteable CD media.

When these optical media are used as information-transmitting media, it is important how to keep a secret of the information stored therein. For example, data stored in a CD can be easily read by a marketed CD drive or CD player. Therefore, a problem which occurs is that secret information is easily leaked, when an optical recording medium storing the secret information is undesirably read by an outsider.

The CD-RW media can be reused by erasing information which has been stored. Information erasing methods for CD-RW include a full-erase method in which all the recorded data are erased and a quick-erase method in which only control data that are necessary for allowing a CD drive access to the information stored in data area of a CD-RW are erased. The quick-erase method is used in order to make a medium quickly be in a state ready for rewriting.

FIGS. 4A and 4B are schematic diagrams illustrating area-structures of a CD-RW medium before and after information is erased by a quick-erase method, respectively. The background erase method is described hereinafter referring to FIGS. 4A and 4B.

In FIG. 4A, reference numerals 41, 42, 43, and 44

designate a program memory area (hereinafter referred to as a PMA), a table of contents area (hereinafter referred to as a TOC area), a program area, and a lead-out area, respectively.

User information is stored in the program area 43 of the CD-RW medium shown in FIG. 4A, and a CD-RW drive gains access to the information of the program area 43 on the basis of control data recorded in the PMA 41. After the control data are further recorded in the TOC area 42 and the lead-out area 44, the information recorded in the CD-RW medium becomes ready to be read by a CD drive such as a CD-ROM drive. This recording is performed using a CD-RW drive.

When the quick-erase method is used, all of the control data stored in filing information areas, i.e., the PMA 41, the TOC area 42, and the lead-out area 44, are erased, whereas the user information recorded in the program area 43 remain intact. However, there are no CD drives which can read the user information stored in the program area 43, because there are no control data in the filing information areas.

Accordingly, there are no methods to read user information stored in the program area 43 of a CD-RW medium when the medium is accidentally erased by the quick-erase method.

SUMMARY OF THE INVENTION

Accordingly, the present invention has been made in view of the above-discussed problems and an object of the present invention is to address and solve these and other problems.

The present invention provides an optical recording medium including an information area that includes a data area in which user information is stored and a filing information area in which control data for access to the user information are to be stored. The data area is in a recorded state, and the filing information area is in an unrecorded state.

The optical recording medium may further include a password that is recorded in a portion of the information area.

The optical recording medium may be a CD-R or a CD-RW which includes an information area including a data area which includes a program area in which user information is stored and an user area in which information can be stored, and a filing information area in which control data for access to the user information are to be stored. The filing information area includes a PMA, a TOC area, and a lead-out area. All of the user area, the TOC area and the lead-out area are in an unrecorded state. Both of the program area and a portion of the PMA are in a recorded state. The optical recording medium may further include a password that

is recorded in a portion of the information area. When the medium is used for a information recording/reading system having system information that is peculiar to the system, the system information may be recorded in the medium. In this case, the system information is used as a password, and the verification of the password may be done by the information recording/reading system automatically. Specifically, when the system information is recorded in the data area, then control data for access to the system information may be further recorded in the PMA.

In another aspect of the present invention, an erase method for erasing CD-RW media is provided, which includes the steps of reading control data stored in a filing information area of a CD-RW medium, recording the control data in another medium, and erasing only the control data in the filing information area of the CD-RW medium.

In still another aspect of the present invention, an information recording/reading system is provided which includes an optical recording medium which includes a file information area including a PMA which is in an non-recorded state and a program area in which user information is stored; a control data storing medium which stores control data for access to the user information stored in the program area; and a recording device which records the control data in the PMA. The optical recording medium may be a CD-R medium or a

CD-RW medium.

BRIEF DESCRIPTION OF DRAWINGS

A more complete appreciation of the present invention and many of the attendant advantages thereof will be readily obtained as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

FIG. 1 is a schematic view illustrating an embodiment of the optical recording medium of the present invention;

FIG. 2 is a schematic view illustrating another embodiment of the optical recording medium of the present invention;

FIG. 3 is a schematic view illustrating yet another embodiment of the optical recording medium of the present invention which has a high level of secrecy;

FIGS. 4A and 4B are schematic diagrams respectively illustrating structures of a CD-RW medium before and after information is erased by a quick-erase method;

FIG. 5 is a schematic diagram illustrating a structure of an embodiment of the optical recording medium of the information recording/reading system of the present invention.

FIG. 6 is a block diagram illustrating another embodiment of the information recording/reading of the present invention; and

FIG.7 is a flow chart illustrating an embodiment of the erase method of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, wherein like reference numerals designate identical or corresponding parts throughout the several views, and more particularly referring to FIG. 1 thereof, there is shown an embodiment of the optical recording medium of the present invention. The optical recording medium is a CD-R medium. Alternatively, the optical recording medium may be a CD-RW medium. At the center of the optical recording medium 10, a hole 11 in which a pivot of a drive can fit is provided. The optical recording medium includes an information area having a PMA 13, a TOC area 15, a program area 17, and an area 19 having a recordable user area and a lead-out area, which are disposed one by one from the inside to the outside. In the PMA 13 in FIG. 1, the hatched area inside of a broken line circle is a recorded area in which PMA data are recorded. The other portion of the PMA, which is outside the broken line circle and which is inside the solid line circle of the PMA 13, is in an unrecorded state. The TOC area 15 and the area 19 are in an unrecorded state. Prescribed user information or requested user information is stored in the program area 17.

Namely, the optical recording medium 10 shown in FIG. 1

includes the PMA 13, the program area 17 that is in an recorded state, and the TOC area 15 and the area 19 that are in an unrecorded state and in a record-able state. Further, the hatched portion of PMA 13, which relates to the program area 17, is in a recorded state. The PMA 13, the TOC area 15, and the lead-out area are referred to as a file information area. The program area 17 and the user area are referred to as a data area.

Control data and information can be respectively recorded in the PMA 13 and the program area using a CD writing drive. Alternatively, the medium may be a hybrid-type medium that includes a record-able area and a ROM (read only memory) area in which pits are previously formed using a stamper. In addition, the medium 10 may further include additional area such as a PCA (power calibration area).

Even in an undesirable case that an outsider intends to read user information stored in the program area, the outsider cannot read or play the optical recording medium by a CD player or a CD-ROM drive. This is because CD players or CD-ROM drives cannot read information stored in a CD medium if control data are not recorded in the TOC area 15. Therefore, the secrecy of the user information stored in the program area of the optical recording medium 10 can be maintained against the outsider not having a CD writing drive.

A person, who should read the user information, can read

the user information by finalizing the optical recording medium using a CD writing drive marketed. Namely, the CD writing drive reads the PMA data recorded in the PMA 13, and then record TOC data in the TOC area 15 in accordance with the PMA data. At the same time, the CD writing drive records lead-out data in the lead-out area. Thus, the medium 10 becomes a state in which the information stored therein can be read by CD drives. After this finalization of the medium, the right person can read information stored in the medium using a CD player or a CD-ROM drive as well as the CD writing drive.

The information transmitting method using such an optical recording medium is useful for, for example, a circle consisting of limited members in which limited user information is distributed to the members. The individual member possesses a CD writing drive to read the user information. Information provider such as a bank, a stockbrokerage company, or a research company records user information for the limited members in the program area 17 of the optical recording medium 10 as shown in FIG. 1, and distribute the recorded medium 10 to each member. Because the medium 10 distributed cannot be read with a CD player or a CD-ROM drive marketed, secrecy of the distributed information is to be secured even when the medium 10 passes into a person other than the members, for example, by

miscarriage or robbery.

In this case, the information stored in the medium 10 can be read if an outsider has a CD writing drive. The present invention provides another optical recording medium which is explained below and in which information stored therein cannot be read even in such a case.

FIG. 2 shows another embodiment of the optical recording medium of the present invention. At the center of an optical recording medium 20, a hole 21 in which a pivot of a drive can fit is provided. The optical recording medium includes an information area having a PMA 23, a TOC area 25, a program area 27, and an area 29 having a recordable user area and a lead-out area. The medium 20 may further include an additional area such as a PCA (power calibration area). The PMA 23 is disposed in an innermost portion of the medium 20, and the PMA 23, the TOC area 25, the program area 27, and the area 29 are disposed one by one in an outward direction.

The TOC area 25, the area 29, and the PMA 23 are in unrecorded state and in a recordable state. Prescribed user information or requested user information is already recorded in the program area 27. Further, a password may be recorded in a predetermined portion of the optical recording medium 20. The predetermined portion may be in the information area or a portion inside the information area, for example, a portion outside the lead-out area, the innermost portion of the TOC

area, or the innermost portion of the PCA, etc.

Namely, the optical recording medium 20 shown in FIG. 2 includes the PMA 23, the TOC area 25, the program area 27 that is in a recorded state, and the area 29 having the user area and the lead-out area, wherein the PMA 23, the TOC area 25, and the area 29 are in an unrecorded state and in a record-able state. The password (not shown) may be recorded in a specific portion of the medium 20.

Before the medium 20 is distributed to members of the circle consisting of limited members mentioned above, the information provider notifies each member of a password that is common for all the members, and by which the information stored in the medium 20 can be read. The provider also notifies the member of PMA (control) data corresponding to the user information recorded in the program area 27.

The member sets the distributed medium 20 on the CD writing drive, and inputs the notified password. The writing drive compares the inputted password with the password stored in the specific portion of the medium. When the inputted password is verified, the drive becomes ready to write.

Next, the member records the notified PMA data in the PMA using the writing drive. The member finalizes the medium 20 by recording TOC data in the TOC area 25 on the basis of the recorded PMA data. Alternatively, the member may finalize the medium using a computer installed with software

for directly recording the TOC data in the TOC area. In this case, the member inputs the notified PMA data to the computer. By this procedure, the finalized optical recording medium 20 becomes readable or playable by CD drives.

Further, when the information provider distributes specific information to a specified member, other than common user information available for every member, another optical recording medium of the present invention as shown in FIG. 3 may be used.

An area 29A of the optical recording medium 30 is a portion in the program area in which specified information is additionally recorded by the provider using a CD writing drive. PMA data regarding the additionally recorded portion of the program area is distributed to the specified member. The member then inputs the password and the specific PMA data to finalize the medium. Thus the medium becomes readable or playable by CD drives.

Even if the medium 30 is handed to an outsider, the outsider cannot read the user information, because the outsider is not notified of the password nor the PMA data regarding the additionally recorded portion. Therefore, the secrecy of the specific information is maintained at a high level.

Further, when a specific password is provided for a specified member other than the common members, the specific

password may be used to cover variety of access ranks among the members. In this case, information of the additionally recorded portion of PMA can be read using the specific password. Accordingly, the specific information is not disclosed by other members, and the secrecy of the stored information is further improved to a higher level than in the case mentioned above.

FIGS. 4A and 4B are schematic diagrams respectively showing structures of a CD-RW medium before and after information is erased by a quick-erase method. With reference to FIGS. 4A and 4B, one embodiment of the erase method according to the present invention is described hereinafter.

In FIG. 4A, reference numerals 41, 42, 43, and 44 designate a PMA, a TOC area, a program area (data area), and a lead-out area, respectively.

The erase method includes a reading step, a recording step, and an erasing step. In the reading step, a drive reads control data stored in the filing information area. In the recording step, another drive records the control data in another medium. Alternatively, a drive equipped with a memory such as DRAM may record the control data in another medium after reading the control data of the optical recording medium. In the erasing step, the drive erases the filing information area that stores the control data. Even

if the control data of the CD-RW medium is accidentally erased by this erase method, the information stored in the program area 43 can be read by re-recording the control data which are recorded in another medium in the filing information area of the CD-RW medium.

Further, a CD-RW medium in which the control data thereof is erased by this method has a higher level of secrecy of user information stored in the program area, when the another medium that stores the control data is kept separately.

FIG. 6 is a block diagram showing one embodiment of the information recording/reading system according to the present invention. An input device 65 such as a keyboard or a mouse is disposed so that an operator can read and record information and initialize a CD-RW medium. In addition, information needed for the system controlling is transferred to the system by the input device 65. A CD-R/RW unit 62 includes a CD-R/RW drive and an optical recording medium selected from the group consisting of CD-R medium and CD-RW medium. An external data storage unit 67 includes another drive and another medium that stores control data for access to the user information stored in a program area of the optical recording medium.

A CPU (Central Processing Unit) 60 controls the input device connected to a bus 66, a display control device 64, a

RAM (random access memory) 61, and the CD-R/RW unit 62. When the system performs prescribed operation or a process, which is directed by the command that is inputted by the input device 65, the system transfers a program to the RAM 61 from the external data storage unit 67. Programs for operating the erase method of the present invention, or other programs for recording and reading information are housed in the external data storage unit 67. The RAM 61 temporarily stores such programs or various kinds of information, which are required for recording and reading information of the CD-RW medium, when the system operates.

The display control device 64 controls a display 63 such as CRT (cathode-ray tube) displays or LCDs (liquid crystal displays) such that information stored in the RAM 61, window images and icons related to various functions are displayed on the display 63. The external data storage unit 67 also stores data for recording or data required for operations of the system, in addition to the above-mentioned program for operating the erase method of the present invention and the program for recording and reading information in the optical recording medium.

The CD-R/RW unit 62 has another CPU and another RAM to record, read and erase information in the CD-RW medium in accordance with a command from the CPU 60.

FIG. 7 is a flow chart illustrating one embodiment of

the erase method according to the present invention. The erase method is further explained hereafter with reference to FIG. 7.

When a CD-RW medium is set on the CD-R/RW drive in the CD-R/RW unit 62, the CD-R/RW drive reads control data stored in a filing information area (a PMA and a TOC area) of the medium, and records the control data in another medium in the external data storage unit 67. Subsequently, the control data stored in the PMA and the TOC area of the CD-RW medium are erased, and further, a lead-out area of the CD-RW medium is erased. With this procedure, the control data in the filing information area is erased, resulting in completion of the erasure.

The CD-RW medium, which has been erased, is identified as an unrecorded medium by an information recording/reading system. Therefore, new data can be recorded on the medium.

Alternatively, the information stored in the data area can be read, by re-recording the control data stored in the medium in the external data storage unit 67 in the filing information area of the CD-RW medium. This operation can be performed only by a person who can access the control data.

The program area may be recorded using a writing drive that is capable of recording the optical recording medium. Alternatively, the medium may be a hybrid-type medium that includes a recordable area and a ROM (read only memory) area

in which pits are previously formed using a stamper.

In addition, when the control data are re-recorded in the PMA of the erased CD-RW medium which is required to recover, the following method can also be used. As shown in FIG. 5, system information that is peculiar to the system is additionally recorded in the data area (program area) as shown in FIG. 5. Then the control data for access to the system information and the user information stored in the program area are recorded in the PMA 41. Further, control data are recorded in the TOC area and the lead-out area so that CD drives can read the information stored in the CD-RW medium. If the access is allowed only when the additionally recorded system information is verified to be the same as the current system information of the system, the secrecy of the information stored in the CD-RW can further improved.

Further, when an application program and an installation program are recorded in the program area 43, the secrecy can be improved using a method in which the application program can be installed when additionally recorded system information is verified to be the same as the current system information.

As described above in detail, the present invention provides a novel optical recording medium, erase method, and information recording/reading system.

The optical recording medium of the present invention

has high level of secrecy of user information stored therein.

Obviously, numerous modifications and variations of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope the appended claims, the invention may be practiced otherwise than as specifically described herein.

WHAT IS CLAIMED IS:

1. An optical recording medium comprising an information area comprising:

a data area in which user information is stored; and

a filing information area in which control data for access to the user information are to be stored, wherein the data area is in a recorded state, and the filing information area is in an unrecorded state.

2. An optical recording medium according to claim 1, wherein a password is recorded in a portion of the information area.

3. An optical recording medium comprising an information area comprising:

a data area which comprises a program area in which user information is stored and an user area in which information can be stored; and

a filing information area in which control data for access to the user information are to be stored, and which comprises a PMA, a TOC area, and a lead-out area; wherein

all of the user area, the TOC area and the lead-out area are in an unrecorded state;

both of the program area and a portion of the PMA are in a recorded state; and

* C L M S *

the optical recording medium is selected from the group consisting of CD-R media and CD-RW media.

4. An optical recording medium comprising an information area comprising:

a data area which comprises a program area in which user information is stored and an user area in which information can be stored; and

a filing information area in which control data for access to the user information are to be stored, and which comprises a PMA, a TOC area, and a lead-out area; wherein

all of the user area, the PMA, the TOC area and the lead-out area are in an unrecorded state;

the program area is in a recorded state; and

the optical recording medium is selected from the group consisting of CD-R media and CD-RW media.

5. An optical recording medium according to claim 4, wherein a password is recorded in a portion of the information area.

6. An erase method for erasing information in a CD-RW medium comprising the steps of:

reading control data stored in a filing information area of a CD-RW medium;

recording the control data in another medium; and

erasing only the control data in the filing information area of the CD-RW medium.

7. An information reading/recording system comprising:

an optical recording medium which comprises a file information area comprising a PMA which is in an non-recorded state and a program area in which user information is recorded;

a control data storing medium which stores control data for access to the user information; and

a recording device which records the control data in the PMA, wherein the optical recording medium is selected from the group consisting of CD-R medium and CD-RW medium.

8. An information recording/reading system according to claim 7, wherein,

the user information is stored as pits.

9. An information recording/reading system comprising:

an optical recording medium which comprises a file information area comprising a PMA which is in an non-recorded state, a program area in which user information is stored, and a recordable area;

a control data storing medium which stores control data

for access to the user information stored in the program area;

a storing device which stores system information which is peculiar to the information recording/reading system;

a recording device which records the control data in the PMA, and which further records the system information in the recordable area, wherein the optical recording medium is selected from the group consisting of CD-R medium and CD-RW medium.

10. An information recording/reading system according to claim 9, further comprising a computer, wherein

the user information comprises an application program and an installation program, and wherein

the installation program is configured to install the application program in the computer when the system information recorded in the optical recording medium is the same as the system information stored in the storing device.

11. An information reading/recording system comprising:

an optical recording medium which comprises a file information area comprising a TOC area which is in an non-recorded state and a program area in which user information is recorded;

a control data storing medium which stores control data



for access to the user information; and

a recording device which records the control data in the TOC area, wherein the optical recording medium is selected from the group consisting of CD-R medium and CD-RW medium.

12. An information recording/reading system according to claim 11, wherein,

the user information is stored as pits.

13. An information recording/reading system comprising:

an optical recording medium which comprises a file information area comprising a TOC area which is in an non-recorded state, a program area in which user information is stored, and a recordable area;

a control data storing medium which stores control data for access to the user information stored in the program area;

a storing device which stores system information which is peculiar to the information recording/reading system;

a recording device which records the control data in the TOC area, and which further records the system information in the recordable area, wherein the optical recording medium is selected from the group consisting of CD-R medium and CD-RW medium.

14. An information recording/reading system according to claim 13, further comprising a computer, wherein

the user information comprises an application program and an installation program, and wherein

the installation program is configured to install the application program in the computer when the system information recorded in the optical recording medium is the same as the system information stored in the storing device.

