NAMEPLATES BY SAND BLASTING USED CD-ROM DISKS

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An enormous amount of CD-ROM disks is expected to be disposed of in the near future. Several examples of reuse of CD-ROM disks have been reported in various web sites. One such example is "the idea of protecting vegetables from birds by making use of light reflection of rainbow colors from used CD-ROM disks." The authors have studied light-reflecting plates for assisting traffic on roads and the manufacture of nameplates by sand blasting CD-ROM disks. The content shown in the following list is reported in this paper.

(1) Information of home pages and patent concerning reuse of abandoned CD-ROM disk.
(2) Structure and feature of CD- ROM disk.
(3) Experiments to reuse CD-ROM disk as optical reflection board of traffic sign
(4) Experiments of marking on CD-ROM disk to reuse it as nameplate and small sign board
(5) Experiments on durability of the CD-ROM disk marked

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1. Introduction

The abandoned CD-ROM disk is almost same quality and same size in the world. And its surface shows a beautiful rainbow color. Then the abandoned CD-ROM disk can be considered as raw material of a small signboard and nameplate.

2. Information of home pages and patent concerning reuse of the abandoned CD-ROM disk

The authors found some examples of the reuse of CD-ROM in the town. Photo.1 shows the case to which it is use by the commodity exhibition. The chocolates were put on CD-ROM. The commodity stands out by using an optical reflection of the iris of CD-ROM. Photo. 2 shows a case where CD-ROM is used as an art work. 15000 sheets of CD-ROMs are pasted to all area of the floor in the room. The following explanation is done for this art work. "When you walk on these CD-ROMs, you can image the sound. You who are surrounded by the sound can watch your self." The name of the work is "Echo and Narcissus". The artist of this art work is Mr. Christian Marclay.

CD-ROM at the blank is sold in the hardware shop. It is written on the bulletin board in this sales corner "The crow can be repulsed by hanging CD-ROM and LD." It is an idea by which an optical reflection of the iris of CD-ROM is applied.

Photo.1 Commodity exhibition

• • • • • Photo.2 Art work

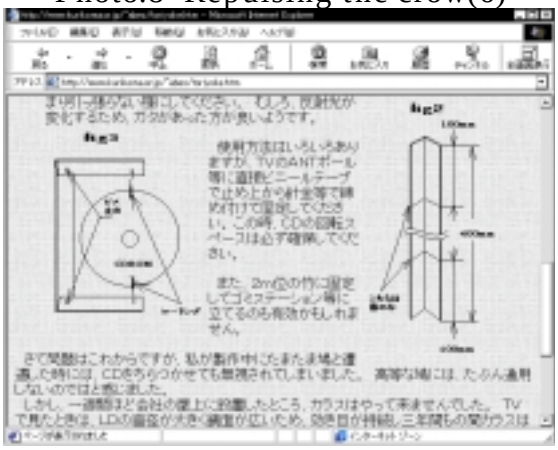
The method of repulsing the bird by CD-ROM is introduced with the television and the newspaper, and is also introduced on the Japanese home pages. Photographs from Photo.3 to Photo.9 show the methods of repulsing the crow and the bird with CD-ROM. Photo.3 and photo.4 show the example defending the vegetable from the crow. This method was introduced with the television. Photo.5 and Photo.6 show the cases where the flower in the parterre in the veranda is defended from the bird. Photo.7 is a case where the bird is made for corn not to be eaten. Photo. 8 shows a reuse of CD-ROM to defend baby ducks from attacking by the crows. Photo.9 shows the method of making the device which takes off the bird by CD-ROM. Photo.10 shows a case where CD-ROM is used for the adornment for the festival. Photo.11 shows a case where the bookends are made with CD-ROM.

Photo.3 Repulsing the crow(1)

Photo.4 Repulsing the crow(2)

Photo.8 Repulsing the crow(6)

Photo.5 Repulsing the crow(3)



• • Photo.9 Repulsing the crow(7)• • • • • •

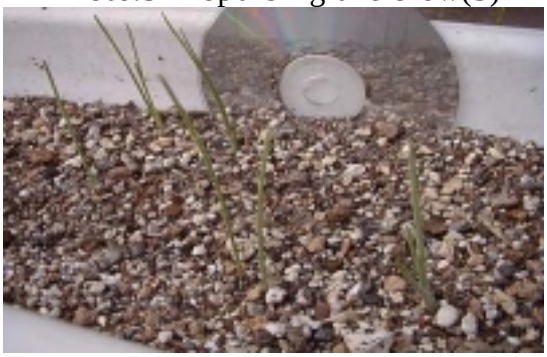


Photo.6 Repulsing the crow(4)

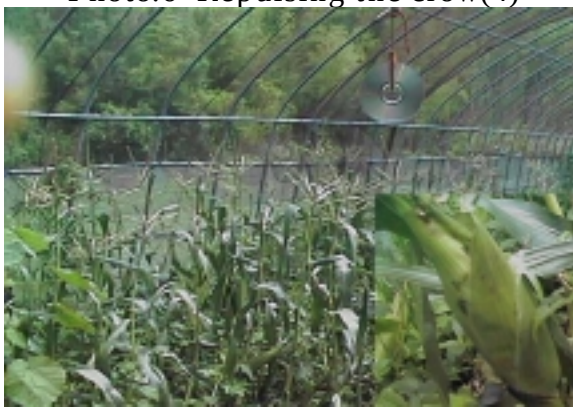


Photo.7 Repulsing the crow(5)

Photo.10 Adornment for the festival

Photo.11 Book end

The other reuse methods of CD-ROM introduced on Japanese home pages are the following ten ideas. These ideas are explained only by sentences, and neither figure nor the photograph are shown.

(1) Eyes of snowman
(2) Flying Disk
(3) Face of clock
(4) Toy in bath
(5) Alternative goods of wall tile in building
(6) Stand for ashtray
(7) Coaster
(8) Cutter mat
(9) Hand glass by mini-CD-ROM
(10) Sunglasses made by tying two CD-ROMs.

URLs on these Japanese home pages are shown together below.

Effective recycling method of CD-ROM (http://www.nsknet.or.jp/~keninoue/cdrom.html)
Might how of CD-RW about such a usage.(http://www.hikarigaoka.gr.jp/wantedif/2211.html)
The device which took off the bird was manufactured. (http://www.kurikoma.or.jp/~abes/toriyoke.htm)
CD-ROM is industrial waste. (http://m.big.or.jp/park/spool/OLD/163.html)
How about such bird's disregarding? (http://www.ask.ne.jp/~nirei/exhibit/toriyoke/toriyoke.htm)
Answer to "Abandonment destination of CD-ROM" (http://m.big.or.jp/park/spool/OLD/156.html)
Making of bookends (http://edin.sci.hiroshima-u.ac.jp/~kinetics/diary/1999/bookend1.jpg)
The saving resource with electronic paper “CD-R" which takes the place of paper (http://sapre.co.jp/cdr.htm)
Reuse of CD-ROM (http://www1.linkclub.or.jp/~kaho/make/cd-rom.html)
Disposal method of CD-ROM of magazine appendix (http://www.sin.co.jp/sato/nb(cd-rom).html)
Answer to " Absorb to CD-R". (http://www.fwnet.or.jp/fwnet-ml/199902.month/3872.html)
Appearance of outdoors breeding of baby ducks (http://www.kamokamo.memenet.or.jp/tadamaki/topics/19990901/index.html)
Corn (http://www.trynet.or.jp/~takaki/hitokoto/toukibi.html)
CD-ROM to avoid crow (http://www.trynet.or.jp/~takaki/etc/etc.html)

There are the following information in the home pages of the United States about abandonment CD-ROM.

There's Aluminum in Them Thar CD-ROMs (http://www.pcworld.com/software/multimedia_titles/articles/dec96/1412p300a.html)
CD-ROM Recycling -reply (http://www.envirolink.org/archives/recycle/1313.html)
Disposal of CD-ROM Products

(http://www.navicp.navy.mil/03/03334/disposal.htm)
Recycling CDs
(http://es.epa.gov/new/contacts/newsltrs/htisv6-1.html#recycling)
CD ROM Recycling
(http://www.envirolink.org/archives/recycle/1295.html)
Yeah, They Make Great Coasters, But...
(http://www.ovid.com/newslet/coasters.htm)
Re: CD-ROM Recycling - reply
(http://www.envirolink.org/archives/recycle/1315.html)
CD-ROM recycling
(http://www.law.uh.edu/sla/list/archive/9702/msg00008.html)
Collecting points for old CD-ROMs introduced
(http://www.tagish.co.uk/ethos/news/lit1/8e72.htm)
Recycling Ideas
(http://www.stretcher.com/stories/980312b.htm)
17 ideas of old CD's reuse are introduced in the home page of "Recycle Those Old CD's"
(http://www.makestuff.com/cd.html)
These ideas are
(1) Sun Catcher
(2) Christmas wreath (Photo.12)
(3) Spinning tops for kids
(4) Borders
(5) Use CD as template
(6) Make Christmas ornaments
(7) Mosaic
(8) Make a clock
(9) Wall decorations
(10) Mobile
(11) Paint w/ oil paints
(12) Paint w/ acrylic mixed with multi-purpose sealer
(13) Paint and decorate w/ material, hang or frame
(14) Use as coasters
(15) Make a collage
(16) Garden helper
(17) Make bowls

Reuse as "coaster, Ninja Disks, wall tiles..." are introduced in the home page of "Do Your Bit: Recycling Diskettes and CDs"
.

Photo.12 Christmas Wreaths & Decorations

There was one United States patent, though there was no Japanese patent of the reuse of abandoned CD-ROM.
US5775659 Compact disk drink coaster (July 7,1998)
In this patent, the supporting board is attached to the back face of CD-ROM for coaster of cup and can.

Some reuse methods of CD-ROM introduced above are interesting. While the following information
are those of the industrial recycling methods for solving the recycling problem of CD-ROM which will be abandoned in large quantities.
Do Your Bit: Recycling Diskettes and CDs
(http://wings.buffalo.edu/computing/publications/interface/vol-30/iss-3/html/art11.html)
introduced an information, " We found one company that will accept CDs for recycling to be made into plastic auto parts."
ETHOS News (UK)
(http://www.tagish.co.uk/ethos/news/lit

1/8e72.htm)
report the news of " Collecting points for old CD-ROMs introduced." Its content is " Roughly 500 places in Germany offer the collection of points for used CD-ROMs" and " Collected CD-ROMs will be processed by a recycling company using an environment-friendly procedure.
The raw material resulting from that process can be used for metallic spraying, medical technology, household goods or the automobile industry."
Japanese company report the recycling of CD-R (http://www.sony.co.jp/soj/CorporateInfo/ecoplaza/experiment_d.html) About 20 mg of Gold and dye staff are respectively recovered from one CD-R disk (Photo.13).

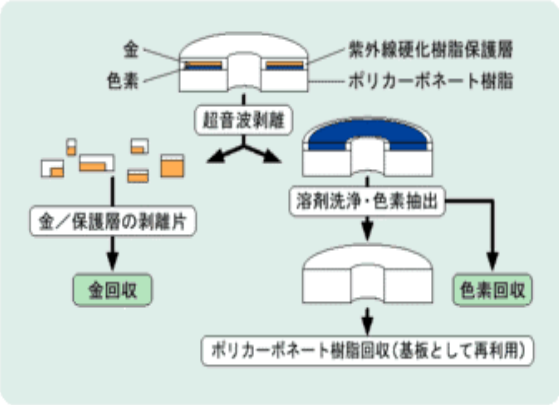


Photo.13 Recycling of gold and dye staff from CD-R

More ideas will be necessary though a lot of people all over the world feel the necessity of the recycling of CD-ROM strongly.

3. Structure and feature of CD-ROM

The structure of CD-ROM, CD-W and CD-WR are explained on some home pages. These home pages are shown from photo.14 to Photo.16.
CD-R is newly put on the market. (http://www.tdk.co.jp/tjaah01/aah0300 0.htm)
The future of CD-R (http://www.yuden.co.jp/)
The second feature: Simple structure(http://www.yuden.co.jp/)

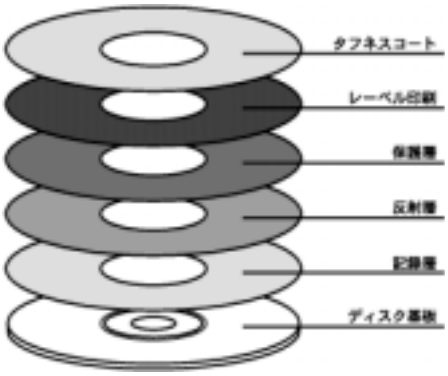


Photo.14 CD-R

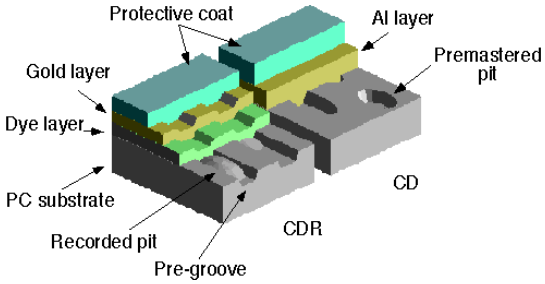


Photo.15 CD-WR(1)

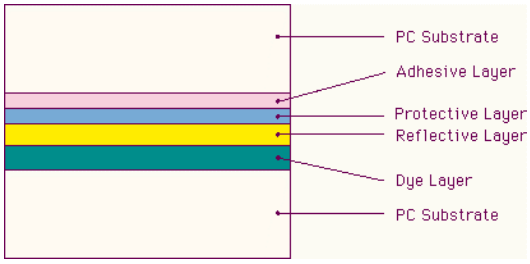


Photo.16 CD-WR(2)

Table 1 shows the feature of CD-ROM and the possibility of reuse. The optical reflection board for the traffic sign ,nameplates and small signboards were experimented on.

Table 1 Feature of CD-ROM and possibility of reuse

Feature	Ideas
Optical reflection of iris	Commodity exhibition board (already known method)

	Art work (already known method) Bird's repulse board (already known method) Optical reflection board of traffic sign Nameplate or small sign board
Disk of accurate size and common size	Targets for coin throw game, darts and rifle practice
Hole of accurate size and common size	Targets for coin throw game, darts and rifle practice

4. Experiment to use CD-ROM as optical reflection board of traffic sign

The folder (photo.17) for changing the direction and inclination of CD-ROM was made. The optical reflection performance of CD-ROM by applying the headlight of the car was examined. The function of the optical reflection board is accomplished as shown in photo.18. Photo.19 shows experimental results of the optical reflection performance of CD-ROM with those of an optical reflection plate and the optical reflection tape on the market. In this case, the headlight of the car was applied. CD-ROM showed the same optical reflection degree as those of an optical reflection plate and the optical reflection tape on the market.

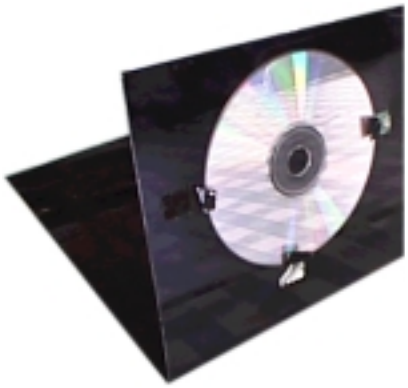


Photo.17 CD-ROM folder

Photo.19 Reflection of light(2)

5. Experiment to use CD-ROM as nameplate and signboard

Various marking methods are applied on CD-ROM to use CD-ROM as a nameplate, a small signboard or a display board. Table 2 shows the table of the experiment result. There are two marking sides. One face is a label side of CD-ROM , and another face is the face where the vapor-deposition layer of aluminum is shown. The latter face is the aluminum reflection side of CD-ROM .

Table 2 Result of marking experiment

Marking method	Label side	Aluminum reflection side
print	×	•
clipping character	×	•
machine sculpture	•	•
Sand blast	•	•
carbon dioxide laser	•	•
YAG laser	•	•

Marking experiments were carried out on these two faces of CD-ROM. When characters are marked on the label side of CD-ROM by the print method or by the cutting character method, distinction of these characters are difficult. These methods are not the appropriate marking methods. Therefore, the signs of X were put in Table 2. When the aluminum reflection side of CD-ROM is marked by the print method and the clipping character method, the character looks good in the background of an optical reflection of the iris. Therefore, the round signs were put in Table 2. When a new character is marked by the machine sculpture, sand blast or the laser marking on the label side of CD-ROM, the distinction between characters on the label side and new characters is difficult. These methods are not desirable marking methods. However, because a part on the label side has been deleted by marking, the part of the mark penetrates light. Therefore, CD-ROM marked can be used for the display by the penetration light.• Then, the triangular signs were put on Table 2. The mark of opaque white is drawn on an iris optical reflection side, when mark is drawn by the machine sculpture, by the sand blast, and by the laser marking on the aluminum reflection side. At this time, it is necessary to prevent the depth of the mark from reaching the aluminum deposition layer. A part on the aluminum deposition side is deleted when the depth of the mark is deep. And, the section in the aluminum deposition layer can be exposed. As a result, aluminum corrodes. The samples to be marked on the aluminum reflection side of the CD-ROM by various methods are shown on photographs of from Photo.20 to Photo.24

Photo.20 Mark with ink

Photo.21 Mark with cut letters

Photo.22 Mark by sculpture

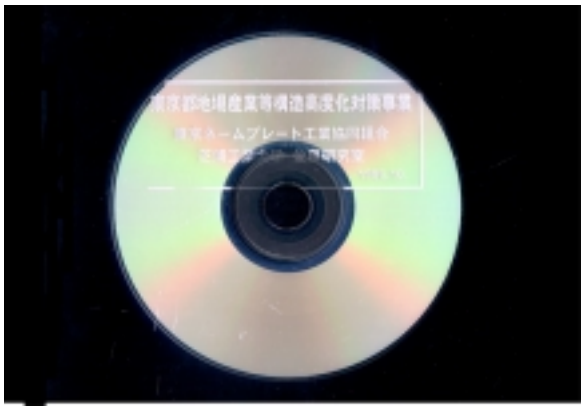


Photo.23 Mark by sand blasting

Photo.24 Mark by laser

It is necessary to remove the oil of the finger which adheres to CD-ROM so as not to ruin the adhesion of the print ink and the clipping character when marking to CD-ROM by the print and the clipping character is done. The surface washing of CD-ROM need not work if there is no cruel dirt at the time of the machine sculpture, the sand blast, and the laser marking.

6. Durability of the CD-ROM marked

To examine durability of the marked CD-ROM used as an optical reflection board, a nameplate, and a signboard in the out door, the ultraviolet rays endurance examination and the saltwater dipping examination of CD-ROM were done. Photo.25 shows the ultraviolet rays irradiation examination box. The distance of the lamp and the sample was assumed to be 30cm with the ultraviolet rays lamp of 35 watts. The ultraviolet rays irradiation was done for one month. Luster had disappeared somewhat on the label side of CD-ROM. The oil of the finger which adhered to the aluminum reflection side became cloudy because of ultraviolet rays though the polycarbonate resin on the aluminum reflection side was not changed.

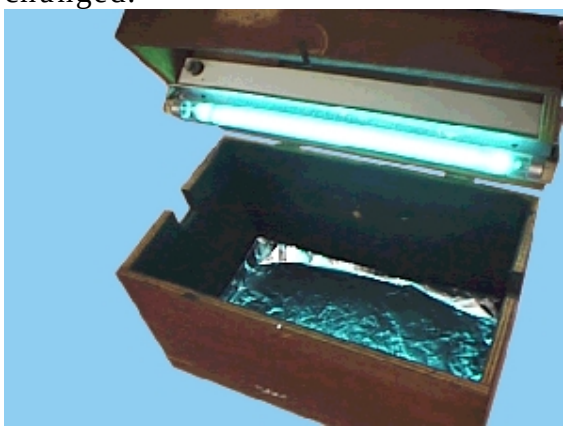


Photo.25 Ultraviolet rays irradiation examination box

The saltwater dipping examination of CD-ROM were done on the marked CD-ROM. The aluminum deposition film of CD-ROM has been sealed up by the polycarbonate resin substrate and the label protection film. CD-ROM

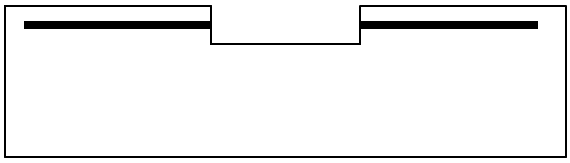
does not corrode with salt water. However, when the deposition film of aluminum has been exposed to the cutting side, aluminum corrodes with salt water. The CD-ROM marked by machine sculpture is shown in Photo.26 (A). This CD-ROM after the saltwater dipping examination is shown in Photo.26 (B). Aluminum at the part marked was

(A) Before the corrosion test

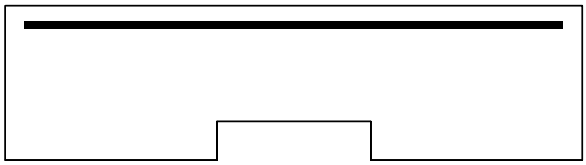
(B) After the corrosion test

Photo.26 Salt waster dipping Examination

corroded,• because the deposition layer of aluminum has been exposed. This fact is a point noted when you mark CD-ROM by the machine sculpture, the sand blast, and the laser. A thin label tears when marking CD-ROM from the label side by the machine sculpture, the sand blast, and the laser as shown in Fig.1(A). The aluminum deposition layer is exposed. Moreover, when the hollow of the mark is deep, the aluminum deposition layer is exposed even when marking CD-ROM from the aluminum reflection side. Marking by the machine sculpture and marking by the laser make a deep hollow. However, marking by the sand blast does not make a deep
hollow (Fig.1(B)). And aluminum deposition layer is not exposed. Therefore, the durable marking method for the CD-ROM is the sand blasting method.



(A) Marking on the label side



(B) Marking on the aluminum reflection side

Fig.1 Schematic view of cross section of the marked CD-ROM

7. Conclusion

(1) Many information of reuse and recycling CD-ROM are reported in Web Sites.
(2) Abandoned CD-ROM will be used as optical reflection board of traffic sign.
(3) Sand blasting is good for marking

on the abandoned CD-ROM.

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