METHOD FOR MANUFACTURING DATA COMPACT DISKS WITH DOT MATRIX HOLOGRAMS

1. Field of the Invention

The present invention relates to a method for manufacturing compact disks, more particularly, to a method for manufacturing data compact disks, each having both of the digital data and hologram formed on one surface thereof whereby the hologram can be used for decoration and to suppress counterfeiting.

2. Description of Related Art

Currently, the compact disk (CD) is widely used because it is resilient and has a very high capacity for storing data. Further, to suppress counterfeiting and decorate the compact disk, a picture is often formed thereon. One type of picture formed on the surface of the compact disk is a passive hologram that exhibits a three-dimensional visual effect. Conventional techniques apply the passive hologram on the compact disk by entirely covering one surface of the compact disk with the picture. Consequently, it is impossible to store digital data on the surface with the hologram. However, to protect the CD against counterfeiting, the hologram needs to be on the same side of the disk with the stored data. Therefore, a technique needs to be developed to fulfill this need.

The objective of the present invention is to provide a method for manufacturing compact disks, such that a hologram and digital data can be formed on the same side of the CD.

To achieve the objective, the method of the present invention comprises the steps of calculating, mastering, sputtering, electroforming and duplication. In the calculating step, the sizes of the digital data and the hologram , respectively, and the required areas on the surface of the compact disk for storing the digital data and the hologram are found. In the mastering step, a photoresist film is formed on the

surface of the glass substrate . The digital data and the hologram are recorded onto the photoresist film. In the sputtering step, a thin metal layer is formed on the photoresist film by a sputtering technique. In the electroforming step, the thickness of the thin metal layer is increased by an electroforming technique thereby forming a master disk. In the duplication step, the master disk is detached from the glass substrate to make multiple compact disks, each containing the same digital data and hologram as the master disk.

Other objectives, advantages, and novel features of the invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings.

IN THE DRAWINGS:

FIG. 1 schematically illustrates the parameters that determine the characteristics of an interference pattern;

FIG. 2 shows a flow chart for manufacturing compact disks; and

FIG. 3 schematically illustrates the process for manufacturing compact disks.

The present invention provides a method for manufacturing compact disks, such that a hologram and digital data can be formed on the same side of the CD. The hologram is known as interference pattern, equivalent to irregular fringe. There are many methods for generating the interference pattern. One of them is to generate interference points to be assembled into a hologram, which is known as a dot matrix hologram. The dot matrix hologram technique is the preferred method for use with the present invention.

Similar to a picture showed on a monitor, the dot matrix hologram uses a lot of dots to form an image, wherein each dot represents an interference pattern. With reference to FIG. 1, the characteristics of each interference pattern are determined by the following parameters:

S: pitch,

d: fringe depth,

θ: fringe angle, and

the area of an interference point.

By changing the values of the above parameters, interference points with different visual effects are obtained. Accordingly, pictures with various visual effects, such as convoluting, fading, overlapping and perspective, are provided.

In accordance with the method of the present invention, the above described hologram is formed on a surface of a compact disk together with the digital data. As shown in FIG. 2, the method comprises the steps of calculating, mastering, sputtering, electroforming and duplication.

In the calculating step, the size of the digital data and the required area on the surface of the compact disk for storing the digital data is calculated. The other area on the surface of the compact disk is then used for recording the hologram .

In addition, the time for recording data onto the compact disk, which will be described in detail in the mastering step, has to be estimated. It is known that the digital data and the hologram are recorded onto the compact disk with different equipment. Therefore, the one that requires less time to be recorded onto the surface of the compact disk should be performed first.

In the mastering step, with reference to FIG. 3, a photoresist film (11) is formed on a clean glass substrate (10). Afterwards, a recording process is undertaken using two kinds of laser beam recorder (191, 192) to record the digital data and the hologram onto the photoresist film (11), respectively. The portions of the photoresist film (11) that have been illuminated by the laser beams will have chemical transformations. A developing process is then undertaken by applying a chemical agent to the photoresist film so that those chemically transformed portions

become pits (111). Accordingly, corresponding 0 and 1 digital signals can be generated.

The above described mastering step is processed primarily based on the requirement to record the digital data. The developing time for digital data is estimated in advance. This developing time is also the same one for hologram.

To obtain the optimal visual effect of the hologram in a specific developing time, a test may be performed by changing the exposure time for projecting the laser beam onto the photoresist film (11). That is, many pictures are formed with different exposure times on different positions of the photoresist film (11). After the developing process with a specific time, the best effect among the pictures can be distinguished. Accordingly, the corresponding exposure time for generating the best picture is adopted for recording the digital data and hologram onto the photoresist film (11).

In the sputtering step, with reference to FIG. 3 again, a thin metal layer (12) is formed on the photoresist film (11) by a sputtering technique. In the electroforming step, the thickness of the thin metal layer (12) is increased by electroforming technique thereby forming a master disk (18). In the duplication step, the master disk (18) is detached from the glass substrate (10). As shown in FIG. 3, copies of the master compact disk (18), each containing the same digital data and hologram as the master disk (18), are produced by pressing a PC plastic (17) onto the master disk (18). Therefore, mass production of the compact disk (16) can be achieved. Finally, the surface of the compact disk (16) is coated with a reflective layer (13) by a sputtering technique and further covered with a protective layer (14) by coating protective glue thereon.

Although the present invention has been explained in relation to its preferred embodiment, it is to be understood that many other possible modifications and

variations can be made without departing from the spirit and scope of the invention as hereinafter claimed.



CLAIMS:

1. A method for manufacturing data compact disks (16), each having a surface for storing digital data and a hologram , said method comprising the steps of:

(a) finding the sizes of area for said digital data and said hologram , respectively, and the required areas on the surface of said compact disk (16) for recording said digital data and said hologram;

(b) preparing a glass substrate (10) with a photoresist film (11), and recording said digital data and said hologram onto said photoresist film (11);

(c) developing said photoresist film (11), and forming a thin metal layer (12) on said photoresist film (11) by sputtering;

(d) increasing the thickness of said thin metal layer (12) by electroforming thereby forming a master disk (18); and

(e) detaching said master disk (18) from said glass substrate (10) for duplicating multiple compact disks (16), each containing the same digital data and hologram as the master disk (18).

2. The method for manufacturing data compact disks (16) as claimed in claim 1, wherein, in step (a), the size of said digital data and the required area on the surface of said compact disk (16) for storing said digital data are calculated , and the other area on the surface of said compact disk (16) can be used for recording said hologram.

3. The method for manufacturing data compact disks (16) as claimed in claim 2, wherein, in step (b), said photoresist film (11) is formed on a surface of said glass substrate (10) .

4. The method for manufacturing data compact disks (16) as claimed in claim 3, wherein, in step (b), two kinds of laser beam recorder (191, 192) are provided to record digital data and hologram, respectively, onto said photoresist film (11)

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followed by a developing process.

5. The method for manufacturing data compact disks (16) as claimed in claim 4, wherein, in step (e), a compact disk (16) is duplicated from said master disk (18) by pressing PC plastic (17) onto said master disk (18).

6. The method for manufacturing data compact disks (16) as claimed in claim 1, wherein said hologram is a dot matrix hologram .