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METHOD OF PRODUCTION OF MULTILAYER OPTICAL RECORDING

MEDIUM

5 BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a method of production of a multilayer optical recording medium obtained by stacking a plurality of optical recording layers for optically recording information.

2. Description of the Related Art

Recently, in the field of information recording, studies on the method of optical information recording are underway everywhere. Optical information recording systems have numerous advantages such as the fact that non-contact recording and reading are possible, and it is possible to handle various forms of memories such as the reading-only type, write-once type, and rewritable type, etc. This system has broad potential applications from industrial to consumer use as a system able to realize inexpensive and large size files.

Among these, in particular, optical disks designed for use as reading-only type memories, that is, high density information recording media and optical video disks called "digital audio disks", "digital

versatile disks", etc. have come into wide use.

This type of optical disk is configured by a transparent substrate formed with a pattern of irregularities such as pits to represent signal
5 information and grooves, that is, an optical disk substrate, a reflection film comprised of an aluminum film or other metal thin film formed on the substrate, and a protection film for protecting the reflection film from moisture and oxygen in the air formed on the
10 reflection film. When reading information of such an optical disk, for example, laser or other light for reading is focused on the pattern of irregularities from the optical disk substrate side and information is detected from the difference of reflectivity between the
15 incident light and the returning light.

When producing such an optical disk, first, an optical disk substrate having the above pattern of irregularities is formed by a method such as injection molding, a reflection film comprised of a metal thin film
20 is formed by vapor deposition or other method on this, and an ultraviolet light setting resin etc. is coated on this to form a protection film.

Recently, the demand for larger capacities of such optical disks has increased. To meet with this, an
25 optical disk has been proposed which is obtained by

forming a pattern of irregularities on one surface of the optical disk substrate, forming a semi-transparent film over this, forming a pattern of irregularities on this semi-transparent film separated by a distance of several
5 10s of μm , and forming a reflection film over this to thereby give a total of two optical recording layers.

The above optical disk having a plurality of optical recording layers has a large capacity and is expected to improve productivity and to be able to be
10 produced easily.

As the method for the above, for example, there is the method of coating an ultraviolet light setting resin on a stamper having a pattern of irregularities, curing this by irradiating ultraviolet light while
15 pressing a flexible film, then separating the stamper to transfer the pattern of irregularities to the ultraviolet light setting resin cured in a state bonded to the flexible film, forming a semi-transparent film on the pattern of irregularities of the obtained cured resin
20 film to form the first stack having one optical recording layer, on the other hand, forming a substrate having a pattern of irregularities by injection molding, forming a reflection film on the obtained pattern of irregularities to similarly form the second stack having one optical
25 recording layer, then bonding together the first stack

and the second stack.

However, in the above conventional method of production of an optical disk having a plurality of optical recording layers, it is difficult to separate the
5 stamper from the resin cured by irradiating the ultraviolet light, so there arise problems that burrs may occur on the cured resin or the resin may adhere on the stamper causing a reduced lifetime of the stamper.

In addition, in the step of forming a semi-
10 transparent film on the cured resin film adhered on the flexible film, since a flexible film is used, it is not easy to handle. Therefore, there also arise problems that film formation is difficult and the flexible film becomes wrinkled during the film formation.

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SUMMARY OF THE INVENTION

The present invention was made in consideration of this situation and has its object to provide a method of production of a multilayer optical recording medium able
20 to be produced without the accompanying difficulty in separating a stamper and while avoiding the difficulties in forming a semi-transparent film etc. on a thin flexible film.

According to a first aspect of the present
25 invention, there is provided a method of production of a

multilayer optical recording medium comprises the steps of forming a first optical recording layer on a substrate formed with a pattern of irregularities, forming a transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof, forming a second optical recording layer on the pattern of irregularities of the transfer substrate, adhering a flexible film at the upper portion of the second optical recording layer by an adhesive layer, separating the second optical recording layer and the transfer substrate at their boundary to transfer the second optical recording layer to the flexible film, and bonding together the first optical recording layer and the second optical recording layer with them facing each other.

15 In the method of production of a multilayer optical recording medium of the present invention, preferably the first optical recording layer is formed by a reflection film.

20 In the method of production of a multilayer optical recording medium of the present invention, preferably the second optical recording layer is formed by a semi-transparent film.

25 In the method of production of a multilayer optical recording medium of the present invention, preferably the second optical recording layer is formed by sputtering.

In the method of production of a multilayer optical recording medium of the present invention, preferably the second optical recording layer is made from a material including at least one of aluminum, silver, and silicon.

In the method of production of a multilayer optical recording medium of the present invention, a first optical recording layer is formed by a reflection film etc. on a substrate formed with a pattern of irregularities. On the other hand, a transfer substrate is formed which is comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof. Next, a second optical recording layer is formed by a semi-transparent film, etc. on the pattern of irregularities of the transfer substrate. Next, a flexible film is adhered at the upper portion of the second optical recording layer by an adhesive layer. Next, the second optical recording layer and the transfer substrate are separated at their boundary to transfer the second optical recording layer to the flexible film. Next, the first optical recording layer and the second optical recording layer are bonded together with them facing each other.

Therefore, production is possible without requiring the step of separating a stamper from a resin cured by

irradiating ultraviolet light and the step of forming a semi-transparent film on a thin flexible film. Production is possible without the accompanying difficulty in separating the stamper and while avoiding the
5 difficulties in forming a semi-transparent film on a thin flexible film.

According to a second aspect of the present invention, there is provided a method of production of a multilayer optical recording medium comprises the steps
10 of forming a first optical recording layer on a substrate formed with a pattern of irregularities, forming a first transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof, forming a second optical recording layer on the pattern
15 of irregularities of the first transfer substrate, adhering a flexible film at the upper portion of the second optical recording layer by an adhesive layer, separating the second optical recording layer and the first transfer substrate at their boundary to transfer
20 the second optical recording layer to the flexible film, forming a second transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof, forming a third optical recording layer on the pattern of irregularities of the second transfer substrate, bonding together the third optical
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recording layer and the first optical recording layer
with them facing each other, separating the third optical
recording layer and the second transfer substrate at
their boundary to transfer the third optical recording
5 layer onto the first optical recording layer, bonding
together the second optical recording layer and the third
optical recording layer with them facing each other.

In the method of production of a multilayer optical
recording medium of the present invention, preferably the
10 third optical recording layer is formed by a semi-
transparent film.

In the method of production of a multilayer optical
recording medium of the present invention, preferably
after the step of transferring the third optical
15 recording layer onto the first optical recording layer,
steps of forming a transfer substrate comprised of an
acrylic resin formed with a pattern of irregularities on
a surface thereof, forming an optical recording layer on
the pattern of irregularities of the transfer substrate,
20 and adhering the optical recording layer by an adhesive
layer to transfer the optical recording layer are
repeated.

According to a third aspect of the present
invention, there is provided a method of production of a
25 multilayer optical recording medium comprises the steps

of forming a first optical recording layer on a substrate
formed with a pattern of irregularities, forming a first
transfer substrate comprised of an acrylic resin formed
with a pattern of irregularities on a surface thereof,
5 forming a second optical recording layer on the pattern
of irregularities of the first transfer substrate,
adhering a flexible film at the upper portion of the
second optical recording layer by an adhesive layer,
separating the second optical recording layer and the
10 first transfer substrate at their boundary to transfer
the second optical recording layer to the flexible film,
forming a second transfer substrate comprised of an
acrylic resin formed with a pattern of irregularities on
a surface thereof, forming a third optical recording
15 layer on the pattern of irregularities of the second
transfer substrate, bonding together the third optical
recording layer and the second optical recording layer
with them facing each other, separating the third optical
recording layer and the second transfer substrate at
20 their boundary to transfer the third optical recording
layer onto the second optical recording layer, bonding
together the first optical recording layer and the third
optical recording layer with them facing each other.

In the method of production of a multilayer optical
25 recording medium of the present invention, preferably the

third optical recording layer is formed by a semi-transparent film.

In the method of production of a multilayer optical recording medium of the present invention, preferably
5 after the step of transferring the third optical recording layer onto the first optical recording layer, steps of forming a transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof, forming an optical recording layer on
10 the pattern of irregularities of the transfer substrate, and adhering the optical recording layer by an adhesive layer to transfer the optical recording layer are repeated.

In the method of production of a multilayer optical
15 recording medium of the present invention, a first optical recording layer is formed by a reflection film etc. on a substrate formed with a pattern of irregularities.

On the other hand, a first transfer substrate is
20 formed which is comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof. Next, a second optical recording layer is formed by a semi-transparent film, etc. on the pattern of irregularities of the first transfer substrate. Next, a flexible film is
25 adhered at the upper portion of the second optical

recording layer by an adhesive layer. Next, the second optical recording layer and the first transfer substrate are separated at their boundary to transfer the second optical recording layer to the flexible film.

5 Next, a second transfer substrate is formed which is comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof. Next, a third optical recording layer is formed by a semi-transparent film etc. on the pattern of irregularities of the second
10 transfer substrate. Next, the third optical recording layer is transferred onto the first or second optical recording layer.

 Next, the third optical recording layer is bonded to the first or second optical recording layer together with
15 them facing each other.

 Therefore, when an optical disk having three optical recording layers is produced, therefore, production is possible without requiring the step of separating a stamper from a resin cured by irradiating ultraviolet
20 light and the step of forming a semi-transparent film on a thin flexible film. Production is possible without the accompanying difficulty in separating the stamper and while avoiding the difficulties in forming a semi-transparent film on a thin flexible film.

25 Further, it is possible to produce an optical disk

having four or more optical recording layers by repeating steps of forming a transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof, forming an optical recording layer on the pattern of irregularities of the transfer substrate,
5 and adhering the optical recording layer by an adhesive layer to transfer the optical recording layer after the step of transferring the third optical recording layer onto the first optical recording layer.

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BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become clearer from the following description of the preferred embodiments given with
15 reference to the accompanying drawings, in which:

Figure 1 is a cross-sectional view of a multilayer optical recording medium according to a first embodiment;

Figures 2A and 2B are cross-sectional views of steps of a method of production of the multilayer optical
20 recording medium according to the first embodiment, wherein Fig. 2A shows up to the step of forming a pattern of irregularities for a second optical recording layer on a transfer substrate and Fig. 2B shows up to the step of forming a second optical recording layer;

25 Figures 3A and 3B are cross-sectional views of the

steps continuing from Fig. 2, where Fig. 3A shows up to the step of superimposing a flexible film and Fig. 3B shows up to the step of curing an adhesive;

5 Figures 4A and 4B are cross-sectional views of the steps continuing from Fig. 3, where Fig. 4A shows up to the step of separating a second optical recording layer from a transfer substrate and Fig. 4B shows up to the step of bonding a second stack and a first stack;

10 Figure 5 is a cross-sectional view of a multilayer optical recording medium according to a second embodiment;

 Figures 6A to 6C are cross-sectional views of steps of a method of production of the multilayer optical recording medium according to the second embodiment,
15 where Fig. 6A shows up to the step of forming a pattern of irregularities for a third optical recording layer on a transfer substrate, Fig. 6B shows up to the step of forming a first stack, and Fig. 6c shows up to the step of superimposing a transfer substrate on the first stack;
20 and

 Figures 7A and 7B are cross-sectional views of the steps continuing from Fig. 6, where Fig. 7A shows up to the step of separating a third optical recording layer from a transfer substrate and Fig. 7B shows up to the
25 step of bonding a second stack and a first stack adhered

with a third optical recording layer.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Below, embodiments of the present invention will be
5 described in detail with reference to the accompanying
drawings.

First Embodiment

Figure 1 is a cross-sectional view of a multilayer
optical recording medium (also referred to as "an optical
10 disk" hereinafter) according to the present embodiment.

A pattern of irregularities G_{11} for a first optical
recording layer is formed on a substrate 10 comprised of,
for example, polycarbonate and having a thickness of
about 1.1 mm. On top of this is formed a reflection film
15 comprised of for example 15 nm thick aluminum and having
a pattern corresponding to the above pattern of
irregularities G_{11} , that is, the first optical recording
layer 11. In this way, a first stack 1 is configured.

On the other hand, a semi-transparent film comprised
20 of, for example, 8 nm thick aluminum and formed with a
pattern of irregularities in other steps in advance, that
is, a second optical recording layer 13, is adhered on a
flexible film 15 comprised of for example polycarbonate
and having a thickness of about 70 μm by an adhesive
25 layer 14 such as an ultraviolet light setting resin. In

this way, a second stack 2 is configured.

The first optical recording layer 11 and the second optical recording layer 13 are bonded together with them facing each other by an adhesive layer 12 such as a
5 pressure-sensitive adhesive or an ultraviolet light setting resin-based adhesive. Here, the distance between the first optical recording layer 11 and the second optical recording layer 13 (that is, the thickness of the adhesive layer 12) is several 10s of μm (for example, 27
10 μm).

In this way, an optical disk according to the present embodiment is configured.

The above optical disk is used for example as a surface reading optical disk in which the second optical
15 recording layer 13 and the first optical recording layer 11 are positioned in a range of depth of about 100 μm from the flexible film 15 side and the recorded information is read from the flexible film 15 side.

Next, the method of production of the above optical
20 disk according to the present embodiment will be described with reference to the drawings.

First, as shown in Fig. 2A, by for example injection molding etc., a transfer substrate T is formed which is comprised of an acrylic resin, having a thickness of for
25 example 1.2 mm and formed with a pattern of

irregularities G_{13} for a second optical recording layer on a surface thereof.

Next, as shown in Fig. 2B, aluminum, silver, or silicon is deposited to a thickness of, for example, 8 nm by for example sputtering on a transfer substrate T formed with the pattern of irregularities G_{13} to form a semi-transparent film that has a pattern corresponding to the above pattern of irregularities G_{13} , that is, the second optical recording layer 13.

Next, as shown in Fig. 3A, an ultraviolet light setting resin-based adhesive 14a is supplied onto the second optical recording layer 13 and flattened by spin coating etc. A flexible film 15 comprised of for example polycarbonate and having a thickness of about 70 μm is laid over the adhesive.

Next, as shown in Fig. 3B, ultraviolet light L is irradiated from the flexible film 15 side to cure the adhesive layer 14 and bond the flexible film 15 and the second optical recording layer 13.

Next, as shown in Fig. 4A, the second optical recording layer 13 and the transfer substrate T are separated at their boundary. Due to this, the second optical recording layer 13 is transferred to the flexible film 15 side and a second stack 2 is obtained configured with the second optical recording layer 13 bonded with

the flexible film 15 by an adhesive layer 14.

The aluminum film formed on the transfer substrate T comprised of an acrylic resin by sputtering can be easily separated without damaging the aluminum film. Further,
5 the flexible film 15 is pliable, which makes the separation easier.

Next, as shown in Fig. 4B, the second stack 2 is bonded on the first stack 1 formed in advance by an adhesive layer 12 such as a pressure-sensitive adhesive
10 or an ultraviolet light setting resin-based adhesive.

Here, the first stack is formed by forming a substrate 10 by for example injection molding etc., which is comprised of a polycarbonate, having a thickness of for example 1.1 mm and formed with a pattern of
15 irregularities G_{11} for a first optical recording layer on a surface thereof, depositing aluminum to for example a thickness of 15 nm by for example sputtering on the top of this, and thereby forming a reflection film having a pattern corresponding to the above pattern of
20 irregularities G_{11} , that is, the first optical recording layer 11.

In the step of bonding the second stack 2 and the first stack 1, the first optical recording layer 11 and the second optical recording layer are bonded in the
25 state facing each other. Here, the distance between the

first optical recording layer 11 and the second optical recording layer 13 (i.e., the thickness of the adhesive layer 12) is several 10s of μm (for example 27 μm).

In the above way, the optical disk as shown in Fig. 1 can be produced.

According to the method of production of an optical disk according to the present embodiment, the second optical recording layer comprised of a thin semi-transparent film can be easily transferred to the thin flexible film, so the production is possible without requiring the step of separating a stamper from a resin cured by irradiating ultraviolet light and the step of forming a semi-transparent film on a thin flexible film as in the conventional method. Therefore, production is possible without the accompanying difficulty in separating the stamper and while avoiding the difficulties in forming a semi-transparent film on a thin flexible film.

Second Embodiment

Figure 5 is a cross-sectional view of an optical disk according to the present embodiment.

A pattern of irregularities G_{21} for a first optical recording layer is formed on a substrate 20 comprised of for example polycarbonate and having a thickness of about 1.1 mm. On the top of this is formed, for example, a

reflection film comprised of a 15 nm thick aluminum and having a pattern corresponding to the above pattern of irregularities G_{21} , that is, the first optical recording layer 21. In this way, a first stack 1 is configured.

5 A semi-transparent film comprised of for example 5 nm thick aluminum and formed with a pattern of irregularities in other steps in advance, that is, a third optical recording layer 23, is adhered on the top of the first optical recording layer 21 by an adhesive
10 layer 22 such as an ultraviolet light setting resin.

On the other hand, a semi-transparent film comprised of for example 4 nm thick aluminum and formed with a pattern of irregularities in other steps in advance, that is, a second optical recording layer 25, is adhered on a
15 flexible film 27 comprised of for example polycarbonate and having a thickness of a 50 μm or so by an adhesive layer 26 such as an ultraviolet light setting resin. In this way, a second stack 2 is configured.

The third optical recording layer 23 and the second
20 optical recording layer 25 are bonded together with them facing each other by an adhesive layer 24 such as a pressure-sensitive adhesive or an ultraviolet light setting resin-based adhesive. Here, the distance between the first optical recording layer 21 and the third
25 optical recording layer 23 (i.e., the thickness of the

adhesive layer 22) and the distance between the third
optical recording layer 23 and the second optical
recording layer 25 (i.e., the thickness of the adhesive
layer 24) are several 10s of μm (for example 25 μm),
5 respectively.

In the above way, an optical disk having three
optical recording layers according to the present
embodiment is configured.

The above optical disk is used for example as a
10 surface reading optical disk in which the first optical
recording layer 21, the second optical recording layer
25, and the third optical recording layer 23 are
positioned in a range of depth of about 100 μm from the
flexible film 27 side and the recorded information is
15 read from the flexible film 27 side.

Next, the method of production of the above optical
disk according to the present embodiment will be
described with reference to the drawings.

First, as shown in Fig. 6A, by for example injection
20 molding etc., a transfer substrate T is formed which is
comprised of an acrylic resin, having a thickness of for
example 1.1 mm and formed with a pattern of
irregularities G_{23} for a second optical recording layer
on a surface thereof. Next, aluminum, silver, or silicon
25 is deposited to a thickness of for example 5 nm by for

example sputtering on the transfer substrate T formed with the pattern of irregularities G_{23} to form a semi-transparent film that has a pattern corresponding to the above pattern of irregularities G_{23} , that is, the third
5 optical recording layer 23.

On the other hand, as shown in Fig. 6B, by for example injection molding etc., a substrate 20 is formed which is comprised of polycarbonate, having a thickness of for example 1.1 mm and formed with a pattern of
10 irregularities G_{21} for a first optical recording layer on a surface thereof. Next, aluminum etc. is deposited to a thickness of, for example, 15 nm by, for example, sputtering on the top of this to form a reflection film that has a pattern corresponding to the above pattern of
15 irregularities G_{21} , that is, the first optical recording layer 21. In this way, the first stack 1 is configured.

Next, as shown in Fig. 6C, an ultraviolet light setting resin-based adhesive 22a is supplied onto the first optical recording layer 21 and flattened by spin
20 coating etc. The transfer substrate T formed with the third optical recording layer 23 is laid over the adhesive with the third optical recording layer 23 and the first optical recording layer 21 facing each other.

Next, as shown in Fig. 7A, not illustrated
25 ultraviolet light is irradiated from the transfer

substrate T side to cure the adhesive layer 22 and bond the third optical recording layer 23 with the first optical recording layer 21, then the third optical recording layer 23 and the transfer substrate T are separated at their boundary. Due to this, the third optical recording layer 23 is transferred to the first stack 1 side. Here, the distance between the third optical recording layer 23 and the first optical recording layer 21 (i.e., the thickness of the adhesive layer 22) is several 10s of μm (for example 25 μm).

The aluminum film formed on the transfer substrate T comprised of an acrylic resin by sputtering can be easily separated without damaging the aluminum film.

Next, as shown in Fig. 7B, the second stack 2 formed in advance is bonded on the first stack 1 adhered with the third optical recording layer 23 by the adhesive layer 24 such as a pressure-sensitive adhesive or an ultraviolet light setting resin-based adhesive.

Here, the second stack 2 can be formed in the same way as in the first embodiment.

That is, by for example injection molding etc., a transfer substrate is formed which is comprised of an acrylic resin, having a thickness of for example 1.1 mm and formed with a pattern of irregularities for a second optical recording layer on a surface thereof. Next,

aluminum, silver, or silicon etc. is deposited to a thickness of for example 4 nm by for example sputtering on the transfer substrate T formed with the pattern of irregularities to form a semi-transparent film that has a pattern corresponding to the above pattern of irregularities, that is, the second optical recording layer 25. Next, an ultraviolet light setting resin-based adhesive is supplied onto the second optical recording layer 25 and flattened by spin coating, a flexible film 27 comprised of for example polycarbonate and having a thickness of 50 μm or so is superimposed on this. Next, ultraviolet light is irradiated from the flexible film 27 side to cure the adhesive layer 26. Then, the second optical recording layer 25 and the transfer substrate are separated at their boundary to obtain the second stack 2 of the above configuration.

In the step of bonding the second stack 2 to the first stack 1 adhered with the third optical recording layer 23, the third optical recording layer 23 and the second optical recording layer 25 are bonded together while facing each other. Here, the distance between the third optical recording layer 23 and the second optical recording layer 25 (i.e., the thickness of the adhesive layer 24) is several 10s of μm (for example 25 μm).

In the above way, the optical disk as shown in Fig.

5 can be produced.

According to the above method of production of an optical disk according to the present embodiment, the second or third optical recording layer comprised of the thin semi-transparent film can be easily transferred to the thin flexible film, so the step of separating a stamper from a resin cured by irradiating ultraviolet light and the step of forming a semi-transparent film on a thin flexible film as in the conventional method are not necessary. Therefore, production is possible without the accompanying difficulty in separating the stamper and while avoiding the difficulties in forming a semi-transparent film on a thin flexible film.

The above method of production of a multilayer optical recording medium according to the present embodiment is applicable to recording media including a plurality of optical recording layers regardless of the recording system.

The total number of optical recording layers is not particularly limited. For example, in the second embodiment, third optical recording layer may have a multilayer structure wherein optical recording layers are stacked via adhesive layers etc. In this case, all the intermediate optical recording layers are made semi-transparent films. Such multiple third optical recording

layers can be formed, for example, in the second embodiment, by repeating the step of transfer an optical recording layer from the transfer substrate to the first stack.

5 In the above description, the third optical recording layer is transferred onto the first optical recording layer and the third optical recording layer and the second optical recording layer are bonded together, but it is possible that the third optical recording layer
10 is transferred onto the second optical recording layer, and then, the third optical recording layer and the first optical recording layer are bonded together in order.

The present invention is not limited to the above embodiments.

15 For example, the materials, thicknesses, etc. of the substrate, optical recording layers, adhesive layer between layers, etc. which form the multilayer optical recording medium are not limited to those described in the above embodiments and can be suitably selected.

20 Numerous other modifications can also be made to an extent not changing the gist of the present invention.

 According to the method of production of the multilayer optical recording medium of the present invention, the step of separating a stamper from a resin
25 cured by irradiating ultraviolet light and the step of

forming a semi-transparent film on a thin flexible film
are not required and therefore production is possible
without the accompanying difficulty in separating the
stamper and while avoiding the difficulties in forming a
5 semi-transparent film on a thin flexible film.

While the invention has been described with
reference to specific embodiment chosen for purpose of
illustration, it should be apparent that numerous
modifications could be made thereto by those skilled in
10 the art without departing from the basic concept and
scope of the invention.

CLAIMS

1. A method of production of a multilayer optical recording medium, comprising the steps of:

forming a first optical recording layer on a
5 substrate formed with a pattern of irregularities,
forming a transfer substrate comprised of an
acrylic resin formed with a pattern of irregularities on
a surface thereof,

forming a second optical recording layer on the
10 pattern of irregularities of the transfer substrate,

adhering a flexible film at the upper portion
of the second optical recording layer by an adhesive
layer,

separating the second optical recording layer
15 and the transfer substrate at their boundary to transfer
the second optical recording layer to the flexible film,
and

bonding together the first optical recording
layer and the second optical recording layer with them
20 facing each other.

2. A method of production of a multilayer optical recording medium as set forth in claim 1, wherein the first optical recording layer is formed by a reflection film.

25 3. A method of production of a multilayer optical



recording medium as set forth in claim 1 or 2, wherein the second optical recording layer is formed by a semi-transparent film.

4. A method of production of a multilayer optical recording medium as set forth in claim 1, 2 or 3, wherein the second optical recording layer is formed by sputtering.

5. A method of production of a multilayer optical recording medium as set forth in any one of the preceding claims, wherein the second optical recording layer is made from a material including at least one of aluminium, silver, and silicon.

6. A method of production of a multilayer optical recording medium, comprising the steps of:

forming a first optical recording layer on a substrate formed with a pattern of irregularities,
15 forming a first transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof,

forming a second optical recording layer on the pattern of irregularities of the first transfer
20 substrate,

adhering a flexible film at the upper portion of the second optical recording layer by an adhesive layer,

separating the second optical recording layer
25 and the first transfer substrate at their boundary to



transfer the second optical recording layer to the flexible film,

forming a second transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof,

forming a third optical recording layer on the pattern of irregularities of the second transfer substrate,

bonding together the third optical recording layer and the first optical recording layer with them facing each other,

separating the third optical recording layer and the second transfer substrate at their boundary to transfer the third optical recording layer onto the first optical recording layer,

bonding together the second optical recording layer and the third optical recording layer with them facing each other.

7. A method of production of a multilayer optical recording medium as set forth in claim 6, wherein the third optical recording layer is formed by a semi-transparent film.

8. A method of production of a multilayer optical recording medium as set forth in claim 6 or 7, wherein after the step of transferring the third optical recording



layer onto the first optical recording layer, steps of forming a transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof, forming an optical recording layer on the pattern of irregularities of the transfer substrate, and adhering the optical recording layer by an adhesive layer to transfer the optical recording layer are repeated.

9. A method of production of a multilayer optical recording medium, comprising the steps of:

forming a first optical recording layer on a substrate formed with a pattern of irregularities,

forming a first transfer substrate comprised of an acrylic resin formed with a pattern of irregularities on a surface thereof,

forming a second optical recording layer on the pattern of irregularities of the first transfer substrate,

adhering a flexible film at the upper portion of the second optical recording layer by an adhesive layer,

separating the second optical recording layer and the first transfer substrate at their boundary to transfer the second optical recording layer to the flexible film,



forming a second transfer substrate comprised
of an acrylic resin formed with a pattern of
irregularities on a surface thereof,

forming a third optical recording layer on the
5 pattern of irregularities of the second transfer
substrate,

bonding together the third optical recording
layer and the second optical recording layer with them
facing each other,

10 separating the third optical recording layer
and the second transfer substrate at their boundary to
transfer the third optical recording layer onto the
second optical recording layer,

bonding together the first optical recording
15 layer and the third optical recording layer with them
facing each other.

10. A method of production of a multilayer optical
recording medium as set forth in claim 9, wherein the
third optical recording layer is formed by a semi-
20 transparent film.

11. A method of production of a multilayer optical
recording medium as set forth in claim 9 or 10, wherein after
the step of transferring the third optical recording
layer onto the first optical recording layer, steps of
25 forming a transfer substrate comprised of an acrylic



resin formed with a pattern of irregularities on a surface thereof, forming an optical recording layer on the pattern of irregularities of the transfer substrate, and adhering the optical recording layer by an adhesive layer to transfer the optical recording layer are repeated.

12. A recording medium comprising a multilayer optical recording medium produced according to the method of any one of the preceding claims.

10 13. Apparatus for producing a multilayer optical recording medium, said apparatus being operable according to the method of any one of claims 1 to 11.

