Description

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is in the field of optical information recording media which use a laser beam for recording or writing information thereon, and is more particularly concerned with a reflective metal layer used in such optical information recording media.

Description of the Prior Art

There are several types of optical information recording media, including the ROM type such as a video disk, a compact disk, or the like, which is capable of only playing back information recorded thereon, the so-called WO type (write-once-disk) type which can record information thereon and from which it can be played back, or a rewritable optical recording disk, a magneto-optical record disk, or the like, capable of reading information or recording the same by using a laser beam. In such optical information record media, a reflective metal layer is formed on the back surface of the recording layer or surface.

For example, in an information record medium of the ROM type as described in WO-A-8201098 and shown generally in FIG. 1, there may be provided a video disk of a double-sided type having one major surface consisting of a transparent substrate 1 composed of polycarbonate resin or the like, on which there are formed information pits 2, for example, consisting of concave portions corresponding to recorded information. On the surface of the substrate 1 on which the information pits 2 are formed, there is deposited a reflective metal layer 3 composed of an aluminum film which has been deposited by physical vapor deposition processes such as vacuum evaporation or sputtering. On the reflective metal layer 3 there is coated a protective film 4 composed of an acrylic resin cured, for example, by ultraviolet irradiation. A pair of such substrates 1 each having the information pits 2 as described above are bonded together at their protective films 1 by means of an adhesive agent 5. A laser light is irradiated upon the respective information pits from the back surfaces of the substrates 1 with the reflective pits as shown by an arrow a or b and the presence or absence of the pits 2 is detected, i.e., the information is read by detecting the reflected light from the respective reflection metal layers 3.

However, in an information recording medium of this type having a reflective metal layer made of aluminum, its optical characteristics are sometimes deteriorated, and loss increases upon reading the information. In the WO type or rewritable information record medium, the writing and reading characteristics are occasionally considerably deteriorated. The reason for this is that the reflective metal layer 3 composed of aluminum may become corroded, lowering its reflectivity and it may be recrystallized so as to deteriorate its planar property. For example, although the corrosion-proof properties of aluminum can be improved to a certain degree by using an aluminum having a high purity, its recrystallization cannot be avoided.

JP-A-60 107746 describes a reflective layer for an optical disc consisting of a Ti alloy. The humidity resistance is said to be high.

FR-A-2 561023 describes a transparent anti-corrosion layer which may be made of an Al-Ti alloy.

SUMMARY OF THE INVENTION

The present invention seeks to provide an improved optical information record medium having an improved reflective metal layer. The record medium of the present invention evidences stabilized optical characteristics resulting from the improved reflective metal layer.

In accordance with the present invention, there is provided an optical information record medium which comprises a transparent substrate, an optical information record medium carried by the substrate, and a reflective metal layer associated therewith, characterised by the reflective metal layer being formed of an Al-Ti alloy in which the amount of Ti is between 0.1 and 10 weight %.

Other objects, features and advantages of the present invention will become apparent from the following detailed description of the preferred embodiments, taken in conjunction with the accompanying drawings wherein like reference numerals designate like elements and parts.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a greatly enlarged cross-sectional view of a structure from the prior art to which the present

invention is applicable;
FIGS. 2 to 4, inclusive, represent modified forms of the present invention and illustrate the process for the manufacture of an improved information recording medium according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with the present invention, there is provided an information record medium including a reflective metal layer 3 as shown in FIG. 2. The reflective metal layer 3 is composed of an aluminum alloy layer containing titanium in an amount of from 0.1 to 10 weight %, preferably 0.3 to 3 weight %. This alloy is deposited by a physical vapor deposition method such as vacuum evaporation, sputtering, or the like.

The information record medium containing the reflective metal layer 3 composed of an Al-Ti alloy has stable and improved characteristics. This is due primarily to the fact that the reflective metal layer 3 composed of the Al alloy containing Ti has excellent corrosion-proof properties and avoids crystal growth. In the reflective metal layer 3, however, if the amount of Ti is less than 0.1 weight %, it is difficult to achieve the above-mentioned effects such as the corrosion-proof property and the avoidance of crystal growth. If the amount of Ti exceeds 10 weight %, segregation of Ti is likely to occur, making it difficult to obtain the proper optical characteristics, that is, a uniformly high reflection property. For this reason, the amount of Ti contained in the reflective metal layer 3 should be in the range from about 0.1 to 10 weight %.

EXAMPLE 1

There is illustrated in FIG. 3 a transparent substrate 1 composed of polycarbonate resin, and having deposited thereon a reflective metal layer 3 composed of an Al-Ti alloy with a thickness of 1000 Å. The layer 3 can be applied by a sputtering process using an Al-Ti alloy target. Several samples were made in which the amount of Ti contained in the reflective metal layer 3 was varied from the range of 0.1 to 10 weight %. A comparison sample 1 was made by the above sputtering technique using a pure Al target, without Ti, to obtain a reflective layer composed of Al having a 99.99% purity. Comparison sample 2 was also made by a similar sputtering method to obtain a reflective Al layer containing Ti in an amount of 15 weight %. On the respective samples, a corrosion test was carried out under various testing methods which will be subsequently described. The test results are shown in the following table.

TABLE

Composition of reflective metal layer	Testing Method			
	I	II	III	IV
Al - Ti 99.99 weight %	◎	◎	X	△
Al - Ti 0.05 weight %	◎	◎	X	△
Al - Ti 0.1 weight %	◎	◎	○	○
Al - Ti 0.3 weight %	◎	◎	◎	◎
Al - Ti 0.5 weight %	◎	◎	◎	◎
Al - Ti 1.0 weight %	◎	◎	◎	◎
Al - Ti 3.0 weight %	◎	◎	◎	◎
Al - Ti 5.0 weight %	○	○	◎	◎
Al - Ti 10.0 weight %	○	○	○	○
Al - Ti 15.0 weight %	△	X	X	○

In accordance with testing method I, the reflective metal layer was immersed into a coercive aqueous solution of HCl at a pH of 1 for 30 minutes and then annealed at 70° C at a relative humidity of 90% for one week. Then, the optical transmissivity of a laser beam having a wavelength of 800 nm relative to the reflective metal layers 3 of the samples was measured. The more the reflective metal layer is corroded, the more its optical transmissivity is increased so that its function as a reflective metal layer is degraded. In the table, an optical transmissivity of less than 5% is indicated by a mark◎ , an optical transmissivity or less than 20% is indicated by a mark○ , and an optical transmissivity of more than 20% is indicated by a mark X.

EXAMPLE 2

FIG. 2 illustrates a substrate 1 made of polycarbonate resin and having the information pits 2 formed by concave portions thereof. A reflective metal layer 3 was deposited by a method similar to that of Example 1 on top of which there was formed a protective film 4 composed of acrylic resin which could be cured by ultraviolet irradiation. The protective film 4 was coated to a thickness of 10 microns, thus forming an ROM type information record medium. In this case, samples were also made in which the compositions of the reflective metal layer 3 were varied. The foregoing table shows the test results of corrosion of these

samples according to the following corrosion testing method referred to as method II. According to this testing method, a scratch having a depth reaching to the reflective metal layer 3 from the protective layer 4 was formed on the respective samples. The samples were then immersed into a dilute hydrochloric acid aqueous solution having a pH of 1 for 30 minutes and kept in an atmosphere of 70° C at a relative humidity of 90% for one week. The degree of corrosion was then judged by measuring the corroded length on the line of the above described scratch. In the table, a mark◎ indicates the case where the corrosion speed was loss than 5 mm/week, the markO indicates the case where the corrosion speed was less than 10 mm/week and the mark X indicates the case where the corrosion speed was more than 10 mm/week.

EXAMPLE 3

As shown in FIG. 4, there was provided a substrate 1 made of polycarbonate resin, and sequentially deposited thereon were a first layer 11 made of Sb_2Se_3, a second layer 12 composed of Bi_2Te_3, and a third layer 13 made of Sb_2Se_3 by sputtering. The composite layers formed an information recording layer generally indicated at 14. On the information recording layer, there was deposited a reflective metal layer 3 similarly to Example 1, thus forming an information record medium. The medium was used as the WO-type optical disk in which a laser beam was irradiated on the record layer 14 to thereby change the optical reflectivity. The recording of the information was thus carried out by changes of the optical reflectivity as a result of laser irradiation.

Also in this case, samples were made with different compositions for the reflective metal layer 3. The degree of corrosion was tested in accordance with the following testing method III and the results are indicated on the foregoing table.

According to testing method III, the samples were kept at 70° C and a relative humidity of 90% for 1320 hours and then their corrosion and recrystallization, that is, the occurrence of concavity and convexity, and the degrees thereof, were judged on the basis of the increase of the read bit error rate. In the table, a mark ◎ indicates the case where the error rate was less than 1×10^{-5}, a markO indicates the case where it was more than 1×10^{-6}, and less than 1×10^{-5}, and a mark X indicates the case where it was more than 1×10^{-5}.

EXAMPLE 4

Samples were made by a method similar to Example 1 and on these samples, the time required for the sample to evidence a spike noise after being heated at 70° C was measured. The measured results are indicated on the foregoing table. In the table, a mark◎ indicates the case where the spike noise was not yet produced after one year, a markO indicates the case where it was produced after three months, and a mark Δ indicates the case where it was produced within one month.

As will be seen from the table, the information record medium of the present invention having an Al-Ti reflective metal layer containing Ti in an amount ranging from 0.1 to 10.0 weight %, preferably from 0.3 to 3.0 weight %, was particularly effective in corrosion resistance and the occurrence of concavity and convexity, i.e., the recrystallization was suppressed. Accordingly, the information record medium of the present invention has a stable characteristic for a long time.

In a modified form of the present invention, that of a magneto-optical recording medium, a magnetic layer can be formed on the substrate and sandwiched by transparent dielectric layers. The optical information record medium thus produced was formed of a magnetic material which changes its direction of magnetization upon irradiation by a laser beam. The reflective metal layer was formed on the surface of the dielectric layer.

Various additional metals can be added to the Al-Ti layer for various purposes. For example, one or more of the following elements can be added in the proportions stated:
Pd from 0.01 to 0.3 weight %;
Mn from 0.1 to 1.0 weight %;
Mg from 0.1 to 1.0 weight %;
Si from 0.1 to 1.0 weight % for each 100 parts by weight of the Al-Ti alloy matrix with excellent results being achieved.

In accordance with the present invention, the use of a reflective metal layer 3 of an Al-Ti alloy layer as described provided an information record medium having stable and improved characteristics. The present invention can be applied to information record media such as various kinds of optical disks, optical magnetic disks, and the like having a reflective film to secure the advantages noted above.

Claims

1. An optical information record medium comprising:
a transparent substrate (1),
an optical information record layer (4;14) carried by said substrate, and
a reflective metal layer (3) associated with said optical information record layer, characterised by said reflective metal layer being composed of an Al-Ti alloy containing from 0.1 to 10% by weight Ti.

2. An optical information record medium according to claim 1 wherein said Al-Ti alloy contains from 0.3 to 3.0% by weight Ti.

3. An optical information record medium according to claim 1 wherein said optical information record layer has a row of pits representing recorded information.

4. An optical information record medium according to claim 1 in which said optical information record layer (14) is composed of a material which changes optical characteristics upon irradiation by a laser beam.

5. An optical information record medium according to claim 1 in which said optical information record layer (14) is formed of a magnetic material which changes its direction of magnetization upon irradiation by a laser beam.

6. An optical information record medium according to claim 1 wherein said reflective metal layer (3) contains at least one of the following additives per 100 parts by weight of the Al-Ti alloy:
Pd in 0.01 to 0.3 parts by weight
Mn in 0.1 to 1.0 parts by weight
Mg in 0.1 to 1.0 parts by weight, or
Si in 0.1 to 1.0 parts by weight.

Revendications

1. Support d'enregistrement optique d'informations comprenant :
un substrat transparent (1),
une couche d'enregistrement optique d'informations (4 ; 14) portée par ledit substrat, et
une couche métallique réfléchissante (3) associée à ladite couche d'enregistrement optique d'informations, caractérisé en ce que ladite couche métallique réfléchissante est constituée par un alliage Al-Ti contenant 0,1 à 10 % en poids de Ti.

2. Support d'enregistrement optique d'informations selon la revendication 1, dans lequel ledit alliage Al-Ti contient de 0,3 à 3,0 % en poids de Ti.

3. Support d'enregistrement optique d'informations selon la revendication 1, dans lequel ladite couche d'enregistrement optique d'informations comporte une rangée de cuvettes représentant les informations enregistrées.

4. Support d'enregistrement optique d'informations selon la revendication 1, dans lequel ladite couche d'enregistrement optique d'informations (14) est constituée par un matériau dont les caractéristiques optiques changent lors de l'irradiation par un rayon laser.

5. Support d'enregistrement optique d'informations selon la revendication 1, dans lequel ladite couche d'enregistrement optique d'informations (14) est constituée par un matériau magnétique dont la direction d'aimantation change lors de l'irradiation par un rayon laser.

6. Support d'enregistrement optique d'informations selon la revendication 1, dans lequel ladite couche métallique réfléchissante (3) contient au moins l'un des additifs suivants pour 100 parties en poids de l'alliage Al-Ti :
Pd de 0,01 à 0,3 partie en poids,

CLMS

Mn de 0,1 à 1,0 partie en poids,
Mg de 0,1 à 1,0 partie en poids, ou
Si de 0,1 à 1,0 partie en poids.

Patentansprüche

1. Aufzeichnungsmedium für optische Information mit:
einem lichtdurchlässigen Substrat (1),
einer von dem Substrat gehaltenen Aufzeichnungsschicht (4; 14) für die optische Information, und
einer mit der Aufzeichnungsschicht verbundenen reflektierenden Metallschicht (3),
dadurch gekennzeichnet, daß die reflektierende Metallschicht aus einer Al-Ti-Legierung besteht, die 0,1 bis 10 Gew.-% Ti enthält.

2. Aufzeichnungsmedium nach Anspruch 1, bei dem die Al-Ti-Legierung 0,3 bis 3,0 Gew.-% Ti enthält.

3. Aufzeichnungsmedium nach Anspruch 1, bei dem die Aufzeichnungsschicht eine Reihe von Pits aufweist, die der aufgezeichneten Information entsprechen.

4. Aufzeichnungsmedium nach Anspruch 1, bei dem die Aufzeichnungsschicht (14) aus einem Material zusammengesetzt ist, dessen optische Eigenschaften sich bei Bestrahlung mit einem Laserstrahl verändern.

5. Aufzeichnungsmedium nach Anspruch 1, bei dem die Aufzeichnungsschicht (14) aus einem magnetischen Material gebildet ist, dessen Magnetisierungsrichtung sich bei Bestrahlung mit einem Laserstrahl ändert.

6. Aufzeichnungsmedium nach Anspruch 1, bei dem die reflektierende Metallschicht (3) mindestens einen der folgenden Zusätze auf 100 Gew.-Teile der Al-Ti-Legierung enthält:
Pd von 0,01 bis 0,3 Gew.-Teile,
Mn von 0,1 bis 1,0 Gew.-Teile,
Mg von 0,1 bis 1,0 Gew.-Teile oder
Si von 0,1 bis 1,0 Gew.-Teile.

* C L M S *