

DESCRIPTION

OPTICAL DISC AND ULTRAVIOLET-CURABLE RESIN COMPOSITION
THEREFOR, CURED PRODUCT AND ARTICLE

Technical Field

[0001]

The present invention relates to an optical disc having a recording layer and an ultraviolet-curable resin composition used therefor.

Background Art

[0002]

At present, as a practical optical disc recording medium, there are a CD-R and a CD-RW where a recording layer, a reflecting layer and a protective layer comprising an ultraviolet-curable resin are laminated on a 1.2 mm polycarbonate substrate; and a DVD-R, a DVD+R, a DVD-RW, a DVD+RW and a DVD-RAM where a 0.6 mm polycarbonate substrate and a 0.6 mm polycarbonate substrate equipped with a recording layer and a reflecting layer are bonded with an ultraviolet-curable resin.

[0003]

In addition, recently, a Blu-ray disc (BD-R) having a recording capacity about five-times that of a single layer-type DVD has come to market. The Blu-ray disc is a disc having a structure in which a reflecting layer, a recording layer and an interface layer (also referred to as dielectric layer) are formed on a 1.1 mm transparent or opaque plastic substrate and then an about 0.1 mm light transmitting layer (also referred to as cover layer) is laminated on the interface layer, where recording/reproducing are performed through the light transmitting layer. An organic coloring matter or an inorganic compound is used for the recording layer, and a light transmissive inorganic compound is used for the interface layer. Further, as the light transmitting layer, a cured product layer of an ultraviolet-curable resin is used.

[0004]

In a Blu-ray disc having a recording layer comprising an organic coloring matter, the recording layer is irradiated with a laserbeam and deformation by volume change of an organic coloring matter is used to perform recording. A light information recording medium characterized in that a light transmissive cover layer is formed from a curing resin and the elastic modulus at 25°C in the interface region facing the recording layer is 40 MPa or less for the purpose of supporting volume change of the coloring matter and of obtaining excellent recording signal characteristics (for example, jitter characteristics) (Patent Literature 1), and a light information recording medium having a resin cured product layer with an elastic modulus of 34 to 96 MPa at 25°C on the recording layer of an organic coloring matter (Patent Literature 2) are proposed. However, in these literatures, there is no disclosure about the composition of the resin composition for the cured product layer to achieve such an elastic modulus.

[0005]

In addition, as an evaluation index of reliability of the above-mentioned optical disc recording medium, an environmental test of leaving under the circumstances of temperature: 80°C/relative humidity: 80% RH for 100 hours is conducted. In order that the deterioration rate of the recording signal before and after this environmental test is within a predetermined range, a technique for forming, on an interface layer, a cured product layer of a curing resin containing flexible urethane acrylate as a main component and monofunctional acrylate as a diluent or a curing resin containing urethane acrylate as a main component and monofunctional acrylate and polyfunctional acrylate as a diluent, where the storage elastic modulus is 100 MPa or less at both 5°C and 55°C and the ratio of the storage elastic modulus at 5°C and the storage elastic modulus at 55°C is 10 or less, is proposed (Patent Literature 3). However, this literature only discloses, as described above, that the main component is urethane acrylate and that monofunctional acrylate alone is used or monofunctional acrylate and polyfunctional acrylate are used in combination as a diluent, but does not disclose the specific component composition.

Related technical Literature

Patent Literature

[0006]

[Patent Literature 1] Japanese Patent Laid-Open No. 2008-123631 A

[Patent Literature 2] Japanese Patent Laid-Open No. 2008-269703 A

[Patent Literature 3] Japanese Patent Laid-Open No. 2009-026379 A

Summary of the Invention

Problems to Be Solved by the Invention

[0007]

It is an object of the present invention to provide an optical disc having a recording layer, particularly an organic coloring matter recording layer and a cured product layer of an ultraviolet-curable resin composition of the present invention, and an ultraviolet-curable resin composition capable of imparting excellent recording signal characteristics and durability.

Means of Solving the Problems

[0008]

The present inventors have intensively studied to solve the above problems and found that an optical disc having a cured product layer of an ultraviolet-curable resin composition containing a (meth)acrylate having a structure of the general formula (1) and a recording layer, preferably an organic coloring matter recording layer, shows excellent recording signal characteristics and durability, and the present invention has been completed.

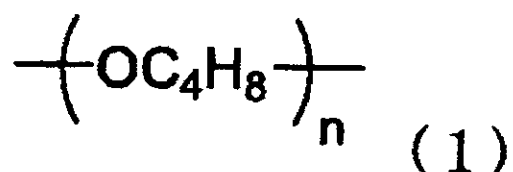
[0009]

That is, the present invention relates to the following (1) to (15).

(1) An optical disc having a cured product layer of an ultraviolet-curable resin composition containing (A) a (meth)acrylate having a structure represented by the

below-described general formula (1) (however, except for butanediol (meth)acrylate), (B) a photopolymerization initiator and (C) a (meth)acrylate other than the above-described (A), and a recording layer:

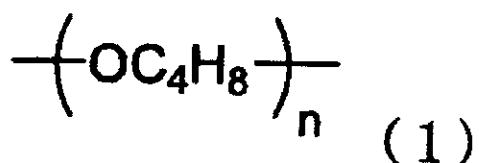
Formula (1)



wherein, n represents an integer number of 1 to 30.

(2) An ultraviolet-curable resin composition for an optical disc having a recording layer, which contains (A) a (meth)acrylate having a structure represented by the below-described general formula (1) (however, except for butanediol (meth)acrylate), (B) a photopolymerization initiator and (C) a (meth)acrylate other than the above-described (A):

Formula (1)

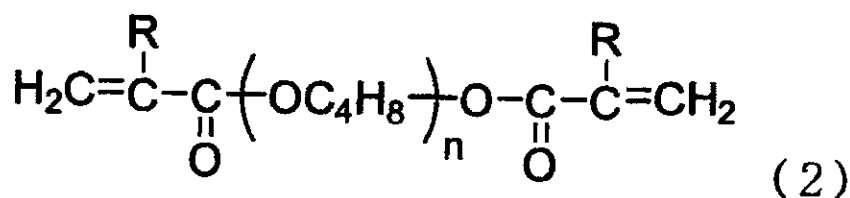


wherein, n represents an integer number of 1 to 30.

(3) The ultraviolet-curable resin composition for an optical disc according to the above-described (2), wherein the above-described (A) (meth)acrylate having a structure represented by the general formula (1) (however, except for butanediol (meth)acrylate) is poly(tetramethylene glycol)di(meth)acrylate or poly(C2 or C3 alkylene glycol-tetramethylene glycol)di(meth)acrylate.

(4) The ultraviolet-curable resin composition for an optical disc according to the above-described (2), wherein the above (meth)acrylate (A) is a (meth)acrylate having a structure represented by the below-described general formula (2):

Formula (2)



wherein, R represents a hydrogen atom or a methyl group, and n represents an integer number of 2 to 10.

(5) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (2) to (4), wherein the above (meth)acrylate (A) is contained in an amount of 20 to 95% by weight based on the whole composition.

[0010]

(6) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (2) to (5), wherein the (meth)acrylate (C) other than (A) is at least one kind selected from the group consisting of epoxy (meth)acrylate (C-1), urethane (meth)acrylate (C-2), and a (meth)acrylate monomer (C-3) other than the above (A), (C-1) and (C-2).

(7) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (2) to (6), wherein the (meth)acrylate (C) other than (A) is either one or both of urethane acrylate or polyethylene oxide-modified bisphenol A-type diacrylate obtained by reaction polyester polyol or polyether polyol with polyisocyanate and 2-hydroxyethyl acrylate.

(8) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (2) to (7), wherein the content of the above (meth)acrylate (A) is 20 to 95% by weight and the content of the (B) photopolymerization initiator is 1 to 10% by weight based on the whole composition, and the rest is the (meth)acrylate (C) other than (A).

(9) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (2) to (8), wherein the elastic modulus at 25°C of the cured product upon curing is 0.01 to 100 MPa.

(10) A cured product obtained by irradiating the ultraviolet-curable resin composition

according to any one of the above-described (2) to (9) with an active energy ray.

(11) The method for manufacturing the optical disc according to the above-described (1), which is characterized in that an optical disc substrate having a recording layer is coated with the ultraviolet-curable resin composition according to any one of the above-described (2) to (9) and irradiated with an active energy ray to form a cured product layer of said resin composition on said optical disc substrate.

(12) Use of the ultraviolet-curable resin composition according to any one of the above-described (2) to (9) for forming a light transmitting layer in an optical disc having a recording layer.

(13) The optical disc according to the above-described (1), which has an organic coloring matter recording layer.

(14) The ultraviolet-curable resin composition according to any one of the above-described (2) to (9), wherein the optical disc is an optical disc having an organic coloring matter recording layer.

(15) The ultraviolet-curable resin composition according to any one of the above-described (2) to (9) and (14), wherein as the (meth)acrylate (C) other than the above-described (A), the urethane (meth)acrylate (C-2) is contained in an amount of 20 to 60% by weight based on the total amount of the resin composition.

Effect of the Invention

[0011]

When an ultraviolet-curable resin composition containing a (meth)acrylate having a structure represented by the general formula (1) of the present invention is used for a light transmitting layer of an optical disc having a recording layer, particularly an optical disc having an organic coloring matter recording layer, an optical disc having high reliability in use for a long period of time in recording and under high temperature and high humidity can be provided.

Mode for Carrying Out the Invention

[0012]

The ultraviolet-curable resin composition of the present invention (hereinafter, also referred to as resin composition of the present invention or as composition of the present invention) contains a (meth)acrylate having a certain structure and a photopolymerization initiator.

[0013]

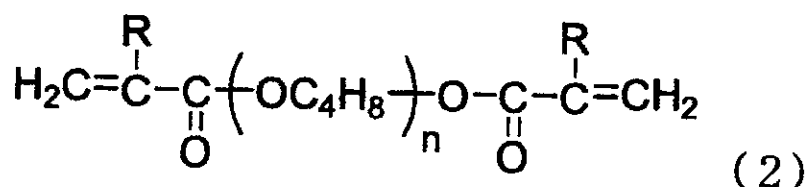
As the (meth)acrylate (A) having a structure represented by the general formula (1) (however, except for butanediol (meth)acrylate) contained in the composition of the present invention, any can be used as long as it is a (meth)acrylate having a structure represented by the general formula (1) except for butanediol mono or di(meth)acrylate. It is preferably monofunctional or polyfunctional polytetramethylene glycol (meth)acrylate, and more preferably bifunctional polytetramethylene glycol di(meth)acrylate, and can usually include poly(tetramethylene glycol)di(meth)acrylate or poly(C2 or C3 alkylene glycol-tetramethylene glycol)di(meth)acrylate. n is usually in the range of 1 to 30, and the above-described "poly" is in the range of "2 to 30". The range is preferably approximately 2 to 20, more preferably approximately 3 to 20, further preferably approximately 3 to 15 and most preferably 2 to 10 or 3 to 10.

The above-described di(meth)acrylate can include poly(tetramethylene glycol)di(meth)acrylate, (ethylene glycol or propylene glycol-tetramethylene glycol)di(meth)acrylate or the like.

Specifically, it can include poly(ethylene glycol-tetramethylene glycol)diacrylate (for example, BLEMMEER ADET series manufactured by NOF corporation), poly(propylene glycol-tetramethylene glycol)diacrylate (for example, BLEMMEER ADPT series manufactured by NOF corporation), polytetramethylene glycol diacrylate (for example, BLEMMEER ADT-250 manufactured by NOF corporation), poly(ethylene glycol-tetramethylene glycol)dimethacrylate (for example, BLEMMEER PDET series manufactured by NOF corporation), poly(propylene glycol-tetramethylene glycol)dimethacrylate (for example, BLEMMEER PDPT series manufactured by NOF

corporation), polytetramethylene glycol dimethacrylate (for example, BLEMME PDT-650 manufactured by NOF corporation) and the like.

Among the above-described di(meth)acrylates, polytetramethylene glycol di(meth)acrylate is preferable, and more preferably, a (meth)acrylate having a structure represented by the general formula (2) is particularly preferable.



(Wherein, R represents a hydrogen atom or a methyl group, and n represents an integer number of 2 to 10.)

[0014]

The (meth)acrylate having a structure represented by the general formula (2) can be produced by dehydration esterification reaction of polytetramethylene glycol with (meth)acrylic acid, ester exchange reaction with lower alkyl acrylic acid ester, or desalination reaction using acrylic acid chloride. As a commercially available compound thereof, for example, a compound of the general formula (2) wherein R is a hydrogen atom and n = 3 is available as BLEMME ADT-250 manufactured by NOF corporation or Light Acrylate PTMGA-250 manufactured by Kyoeisha Chemical Co., Ltd., and a compound of the general formula (2) wherein R is a hydrogen atom and n = 9 is available as NK ESTER A-PTMG-65 manufactured by Shin-Nakamura Chemical Co., Ltd..

[0015]

The content of the (A) component in an ultraviolet-curable resin composition is usually 10 to 95% by weight, preferably 20 to 95% by weight, more preferably 20 to 80% by weight, further preferably 40 to 80% by weight and most preferably 50 to 80% by weight. Less than 10% by weight cannot assist volume change of the coloring matter, resulting in an inferior jitter value (%) as an index of recording signal

characteristics.

[0016]

The photopolymerization initiator (B) contained in the composition of the present invention is not particularly limited but can include, for example, 1-hydroxycyclohexylphenyl ketone (IRGACURE-184; manufactured by CIBA Speciality Chemicals), 2-hydroxy-2-methyl-[4-(1-methylvinyl)phenyl]propanol oligomer (ONE-Rifined), 1-[4-(2-hydroxyethoxy)-phenyl]-2-hydroxy-2-methyl-1-propan-1-one (IRGACURE-2959; manufactured by CIBA Speciality Chemicals), 2-hydroxy-1-{4-[4-(2-hydroxy-2-methyl-propionyl)-benzyl]-phenyl}-2-methyl-propan-1-one (IRGACURE-127; manufactured by CIBA Speciality Chemicals), 2,2-dimethoxy-2-phenylacetophenone (IRGACURE-651; manufactured by CIBA Speciality Chemicals), 2-hydroxy-2-methyl-1-phenyl-propan-1-one (DAROCUR 1173; manufactured by CIBA Speciality Chemicals), 2-methyl-1-[4-(methylthio)phenyl]-2-morpholinopropan-1-one (IRGACURE-907; manufactured by CIBA Speciality Chemicals), 2-benzyl-2-dimethylamino-1-(4-morpholinophenyl)-butan-1-one, 2-chlorothioxanthone, 2,4-dimethylthioxanthone, 2,4-diisopropylthioxanthone, isopropylthioxanthone, 2,4,6-trimethylbenzoyldiphenylphosphine oxide, bis(2,4,6-trimethylbenzoyl)-phenylphosphine oxide, bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphine oxide and the like.

[0017]

In the ultraviolet-curable resin composition of the present invention, these for the (B) component can be used as a mixture of one or more kinds thereof at an arbitrary ratio. The content of the (B) component in the ultraviolet-curable resin composition is usually 0.5 to 20% by weight and preferably 1 to 10% by weight.

[0018]

In addition, an amine or the like which can be a photopolymerization initiating auxiliary agent can be used in combination with the above-described

photopolymerization initiator. Amines and the like which can be used include benzoic acid 2-dimethylaminoethyl ester, dimethylaminoacetophenone, p-dimethylaminobenzoic acid ethylester, p-dimethylaminobenzoic acid isoamylester or the like. When a photopolymerization initiating auxiliary agent such as said amines and the like is used, the content thereof in an adhesive resin composition of the present invention is usually 0.005 to 5% by weight and preferably 0.01 to 3% by weight.

[0019]

As the (meth)acrylate (C) other than (A) contained in the composition of the present invention, a (meth)acrylate having one or more (meth)acryloyl groups can be used. In this regard, the (meth)acrylate in the present invention means methacrylate or acrylate, and its kind is not particularly limited.

As a preferable one, (C-1) an epoxy (meth)acrylate and/or (C-2) a urethane (meth)acrylate, and in addition, (C-3) a (meth)acrylate monomer ((meth)acrylate other than the above (A) component, (C-1) component and (C-2) component) and the like can be used.

[0020]

The epoxy (meth)acrylate (C-1) which can be used in the present invention has a function to improve curing properties and to improve the degree of hardness and the curing rate of a cured product. In addition, as the epoxy (meth)acrylate in the present invention, any can be used as long as it is obtained by reaction of a glycidyl ether-type epoxy compound with (meth)acrylic acid. Preferable glycidyl ether-type epoxy compounds which can be used to obtain said epoxy (meth)acrylate can include diglycidyl ether of bisphenol A or an alkylene oxide adduct thereof, diglycidyl ether of bisphenol F or an alkylene oxide adduct thereof, diglycidyl ether of hydrogen added bisphenol A or an alkylene oxide adduct thereof, diglycidyl ether of hydrogen added bisphenol F or an alkylene oxide adduct thereof, ethylene glycol diglycidyl ether, propylene glycol diglycidyl ether, neopentyl glycol diglycidyl ether, butanediol diglycidyl ether, hexanediol diglycidyl ether, cyclohexanedimethanol diglycidyl ether,

polypropylene glycol diglycidyl ether and the like.

[0021]

The epoxy (meth)acrylate can be obtained by reaction such a glycidyl ether-type epoxy compound with (meth)acrylic acid under the below-described conditions for example.

[0022]

Based on 1 equivalent of the epoxy group in a glycidyl ether-type epoxy compound, the (meth)acrylic acid is reacted at a ratio of 0.9 to 1.5 mol and more preferably 0.95 to 1.1 mol. The reaction temperature is preferably 80 to 120°C, and the reaction time is approximately 10 to 35 hours. In order to facilitate the reaction, it is preferred to use, for example, a catalyst such as triphenylphosphine, TAP, triethanolamine and tetraethyl ammonium chloride. In addition, in order to prevent polymerization during the reaction, it can be also possible to use, for example, paramethoxyphenol, methylhydroquinone and the like as a polymerization inhibitor.

[0023]

In the present invention, as the epoxy (meth)acrylate (C-1), bisphenol A-type epoxy (meth)acrylate obtained from a bisphenol A-type epoxy compound is more preferable. The bisphenol A-type epoxy compound can include diglycidyl ether of bisphenol A or an alkylene oxide adduct thereof, diglycidyl ether of hydrogen added bisphenol A or an alkylene oxide adduct thereof and the like described above.

In the present invention, the molecular weight of the epoxy (meth)acrylate (C-1) is preferably 500 to 10000.

[0024]

The urethane (meth)acrylate (C-2) which can be used in the present invention has a function to modify the viscosity of the resin composition of the present invention and to adjust the elastic modulus of a cured product thereof, and to improve mechanical properties (to reduce warping, deformation and the like) when a cured product layer of said resin composition is used as a light transmitting layer, so recording signal characteristics in an optical disc can be improved.

The urethane (meth)acrylate is obtained by reaction of a polyhydric alcohol, a polyisocyanate and a hydroxy (meth)acrylate compound.

More specifically, it can be obtained by reaction of a polyhydric alcohol with a polyisocyanate to obtain a urethane oligomer, which is then reacted with a hydroxy (meth)acrylate compound.

[0025]

The polyhydric alcohol can include, for example, the below-described polyhydric alcohols.

(i) Aliphatic polyhydric alcohols such as neopentyl glycol, 3-methyl-1,5-pentanediol, ethylene glycol, propylene glycol, 1,4-butanediol, 1,6-hexanediol, trimethylolpropane, pentaerythritol, tricyclodecanedimethylol and bis-[hydroxymethyl]-cyclohexane, and preferably aliphatic polyhydric alcohol having 2 to 10 carbon atoms.

(ii) Polyester polyol obtained by reaction of one kind of the aliphatic polyhydric alcohols in the above-described (i) with polybasic acid.

In this regard, the above-described polybasic acid can include, for example, succinic acid, phthalic acid, hexahydrophthalic anhydride, terephthalic acid, adipic acid, azelaic acid, tetrahydrophthalic anhydride and the like.

(iii) Caprolactone alcohol obtained by reaction of a polyhydric alcohol described above with epsilon-caprolactone.

(iv) Polycarbonate polyol. For example, polycarbonate diol and the like obtained by reaction of a polyhydric alcohol such as 1,6-hexanediol with diphenyl carbonate.

(v) Polyether polyol. For example, poly C2-C4 alkylene glycols such as polyethylene glycol, polypropylene glycol or polytetramethylene glycol, ethylene oxide-modified bisphenol A, and the like.

Among the above-described ones, the polyhydric alcohol is preferably polyether polyol or polyester polyol. The average molecular weight of these is preferably approximately 200 to 8000, more preferably approximately 200 to 3000, further

preferably approximately 300 to 1800 and most preferably approximately 400 to 1500. More preferable is poly C2-C4 alkylene glycol.

In this regard, polyether polyol is particularly preferable in terms of improvement of compatibility.

[0026]

The polyisocyanate (organic polyisocyanate) used in synthesis of the urethane (meth)acrylate (C-2) is preferably diisocyanate, including, for example, isophorone diisocyanate, hexamethylene diisocyanate, tolylene diisocyanate, xylene diisocyanate, diphenylmethane-4,4'-diisocyanate, dicyclopentanyl diisocyanate or the like. Among these, isophorone diisocyanate or tolylene diisocyanate is more preferable.

The hydroxy (meth)acrylate compound used in synthesis of the urethane (meth)acrylate (C-2) includes, for example, hydroxy C2-C8 aliphatic hydrocarbon (meth)acrylates such as hydroxyethyl (meth)acrylate, hydroxypropyl (meth)acrylate, hydroxybutyl (meth)acrylate and dimethylolcyclohexyl mono(meth)acrylate, hydroxycaprolactone (meth)acrylate, and the like. Among them, the hydroxy (meth)acrylate is preferably hydroxy C2-C8 aliphatic hydrocarbon (meth)acrylate, more preferably hydroxy C2-C4 alkyl (meth)acrylate and most preferably hydroxyethyl (meth)acrylate.

[0027]

The above reaction is carried out, for example, as follows. That is, an organic polyisocyanate is mixed with a polyhydric alcohol so that the isocyanate group is preferably 1.1 to 2.0 equivalents per 1 equivalent of the hydroxy group, and the mixture is reacted at a reaction temperature of preferably 70 to 90°C to synthesize urethane oligomer. Subsequently, the urethane oligomer is mixed with a hydroxy (meth)acrylate compound so that the hydroxy group is preferably 1 to 1.5 equivalent per 1 equivalent of the isocyanate group, and the mixture is reacted at 70 to 90°C, so the intended urethane (meth)acrylate can be obtained.

The urethane (meth)acrylate (C-2) is preferably a urethane (meth)acrylate

obtained using polyester polyol or polyether polyol as the polyhydric alcohol, using the above-described diisocyanate as the organic polyisocyanate, and using a hydroxy (meth)acrylate listed above as a preferable hydroxy (meth)acrylate and most preferably 2-hydroxyethyl (meth)acrylate as the hydroxy (meth)acrylate, and it can include, more preferably, a urethane (meth)acrylate (C-2a) obtained from the three of polyester polyol or polyether polyol, diisocyanate, and 2-hydroxyethyl (meth)acrylate.

In addition, in the above, a urethane (meth)acrylate obtained using polyester polyol or polyether polyol having a molecular weight of approximately 200 to 3000 (preferably, a molecular weight of 300 to 1800) is one of the preferable urethane (meth)acrylates (C-2).

Further, in some cases, a urethane (meth)acrylate obtained by reaction of a poly C2 to C6 alkylene glycol having a molecular weight of approximately 300 to 1800, more preferably a C3 to C5 alkylene glycol having a molecular weight of approximately 300 to 1800, isophorone diisocyanate and a hydroxy C2 to C4 (meth)acrylate is also one of the preferable urethane (meth)acrylates (C-2).

[0028]

In addition, it can be also available on markets as UX-0937: polyether-type urethane acrylate (manufactured by Nippon Kayaku Co., Ltd.), and the like. The molecular weight of the urethane (meth)acrylate (C-2) is usually approximately 400 to 10000, preferably approximately 400 to 2000 and more preferably approximately 400 to 1000.

In the resin composition of the present invention, an aspect in which the urethane (meth)acrylate (C-2) is contained is one of the preferable aspects, and may be an aspect in which the urethane (meth)acrylate (C-2) alone is contained as the (C) component and also an aspect in which it is used in combination with another (C) component.

In the resin composition of the present invention, when the urethane (meth)acrylate (C-2) is contained, the content is more than 0%, usually 80% by weight or less, preferably 70% by weight or less and more preferably 60% by weight

or less, based on the total amount of the resin composition. For example, in an aspect in which the urethane (meth)acrylate (C-2) is contained as the (C) component, the content is preferably approximately 20 to 80% by weight, more preferably 20 to 70% by weight or less, further preferably 20 to 60% by weight and most preferably 20 to 50% by weight, based on the total amount of the resin composition. In the content, the urethane (meth)acrylate (C-2) may be contained alone as the (C) component or may be used in combination with the (C-1) component or the (C-3) component.

[0029]

As the (meth)acrylate monomer (C-3), any (meth)acrylate monomer other than the above (A), (C-1) component and (C-2) component can be used. For example, it can include the below-described monofunctional or polyfunctional (preferably, 2 to 6 functional) (meth)acrylates.

For example, the (meth)acrylate monomer having one (meth)acryloyl group can include ethylene oxide-modified phenol (meth)acrylate, isooctyl (meth)acrylate, isoamyl (meth)acrylate, lauryl (meth)acrylate, isodecyl (meth)acrylate, stearyl (meth)acrylate, cetyl (meth)acrylate, isomyristyl (meth)acrylate, tridecyl (meth)acrylate, methoxytripropylene glycol (meth)acrylate, caprolactone-modified hydroxyethyl (meth)acrylate, caprolactone-modified hydroxybutyl (meth)acrylate, benzyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, morpholine (meth)acrylate, phenylglycidyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, ethoxy diethylene glycol (meth)acrylate, tricyclodecane (meth)acrylate, polypropylene glycol (meth)acrylate, polypropylene oxide-modified nonylphenyl (meth)acrylate, isobornyl (meth)acrylate, dicyclopentadiene oxyethyl (meth)acrylate, dicyclopentenyl acrylate (for example, FANCRYL FA-511A manufactured by Hitachi Chemical Co., Ltd.), dicyclopentenyl oxyethyl acrylate (for example, FANCRYL FA-512A manufactured by Hitachi Chemical Co., Ltd.), dicyclopentenyl oxy methacrylate (for example, FANCRYL FA-512M manufactured by Hitachi Chemical Co., Ltd.), dicyclopentanyl acrylate (for example, FANCRYL FA-513A manufactured by Hitachi Chemical Co., Ltd.), dicyclopentanyl methacrylate (for example, FANCRYL FA-513M manufactured

by Hitachi Chemical Co., Ltd.), 1-adamantyl acrylate (for example, Adamantate AA manufactured by Idemitsu Kosan Co. Ltd.), 2-methyl-2-adamantyl acrylate (for example, Adamantate MA manufactured by Idemitsu Kosan Co. Ltd.), 2-ethyl-2-adamantyl acrylate (for example, Adamantate EA manufactured by Idemitsu Kosan Co. Ltd.), 1-adamantyl methacrylate (for example, Adamantate AM manufactured by Idemitsu Kosan Co. Ltd.), ethylene oxide-modified phenoxyated phosphoric acid (meth)acrylate, ethylene oxide-modified butoxyated phosphoric acid (meth)acrylate, ethylene oxide-modified octyloxyated phosphoric acid (meth)acrylate and the like.

[0030]

The (meth)acrylate monomer having one (meth)acryloyl group has a function to improve mechanical properties (suppress warping, deformation and the like) of an optical disc where the ultraviolet-curable resin composition of the present invention is formed as a light transmitting layer.

Here, in viewpoint of imparting excellent signal recording characteristics upon recording and under high temperature and high humidity, it is particularly preferred to use ethylene oxide-modified phenol (meth)acrylate, isooctyl (meth)acrylate, isoamyl (meth)acrylate, lauryl (meth)acrylate, isodecyl (meth)acrylate, stearyl (meth)acrylate, cetyl (meth)acrylate, isomyristyl (meth)acrylate, tridecyl (meth)acrylate, methoxytripropylene glycol (meth)acrylate, caprolactone-modified hydroxyethyl (meth)acrylate, caprolactone-modified hydroxybutyl (meth)acrylate, polypropylene glycol (meth)acrylate, polypropylene oxide-modified nonylphenyl (meth)acrylate or dicyclopentenylloxyethyl acrylate.

[0031]

The (meth)acrylate monomer having two (meth)acryloyl groups as the (C-3) component can include caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate, 2-ethyl-2-butyl-propanediol di(meth)acrylate, 1,9-nonanediol di(meth)acrylate, 1,10-decanediol di(meth)acrylate, cyclohexane-1,4-dimethanol di(meth)acrylate, cyclohexane-1,3-dimethanol di(meth)acrylate,

tricyclodecanedimethylol di(meth)acrylate (for example, tricyclodecanedimethylol diacrylate: KAYARAD R-684 manufactured by Nippon Kayaku Co., Ltd., and the like), dioxane glycol di(meth)acrylate (for example, dioxane glycol diacrylate: KAYARAD R-604 manufactured by Nippon Kayaku Co., Ltd., and the like), neopentyl glycol di(meth)acrylate, dicyclopentanyl di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, ethylene oxide-modified 1,6-hexanediol di(meth)acrylate, polypropylene oxide-modified 1,6-hexanediol di(meth)acrylate, neopentyl glycol di(meth)acrylate, alkylene oxide-modified neopentyl glycol di(meth)acrylate, hydroxypivalic acid neopentyl glycol di(meth)acrylate, polyethylene glycol di(meth)acrylate, polypropylene glycol di(meth)acrylate, alkylene oxide-modified bisphenol A-type di(meth)acrylate, ethylene oxide-modified phosphoric acid di(meth)acrylate and the like.

[0032]

Here, in viewpoint of imparting excellent signal recording characteristics upon recording and under high temperature and high humidity, it is preferable to use caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate, 2-ethyl-2-butyl-propanediol di(meth)acrylate, 1,9-nonanediol di(meth)acrylate, 1,10-decanediol di(meth)acrylate, ethylene oxide-modified 1,6-hexanediol di(meth)acrylate, polypropylene oxide-modified 1,6-hexanediol di(meth)acrylate, alkylene oxide-modified neopentyl glycol di(meth)acrylate, polyethylene glycol di(meth)acrylate, polypropylene glycol di(meth)acrylate or alkylene oxide-modified bisphenol A-type di(meth)acrylate, and more preferably caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate or (poly) C2 to C4 alkylene oxide-modified C6-C15 glycol di(meth)acrylate. In some cases, (poly) C2 to C4 alkylene oxide-modified bisphenol A-type di(meth)acrylate is more preferably.

[0033]

The (meth)acrylate monomer having three (meth)acryloyl groups as the (C-3) component can include caprolactone-modified tris(acryloxyethyl)isocyanurate, trimethylolpropane tri(meth)acrylate, trimethyloldecane tri(meth)acrylate,

trimethylolpropane polyethoxy tri(meth)acrylate, trimethylolpropane polypropoxy tri(meth)acrylate, trimethylolpropane polyethoxy polypropoxy tri(meth)acrylate, tris[(meth)acroyloxyethyl]isocyanurate, pentaerythritol tri(meth)acrylate, ethylene oxide-modified trimethylolpropane tri(meth)acrylate, propylene oxide-modified trimethylolpropane tri(meth)acrylate and the like.

Here, in viewpoint of imparting excellent signal recording characteristics upon recording and under high temperature and high humidity, caprolactone-modified tris(acryloxyethyl)isocyanurate is particularly preferable.

[0034]

The (meth)acrylate monomer having four (meth)acryloyl groups as the (C-3) component can include pentaerythritol polyethoxy tetra(meth)acrylate, pentaerythritol polypropoxy tetra(meth)acrylate, pentaerythritol tetra(meth)acrylate, ditrimethylolpropane tetra(meth)acrylate, dipentaerythritol tetra(meth)acrylate and the like.

The (meth)acrylate monomer having five (meth)acryloyl groups as the (C-3) component can include dipentaerythritol penta(meth)acrylate and the like.

The (meth)acrylate monomer having six (meth)acryloyl groups as the (C-3) component can include caprolactone-modified dipentaerythritol hexa(meth)acrylate, dipentaerythritol hexa(meth)acrylate and the like. In this regard, the (meth)acrylate monomer which can be used in the present invention may be also polyfunctional one having seven or more (meth)acryloyl groups.

Here, in viewpoint of imparting excellent signal recording characteristics upon recording and under high temperature and high humidity, caprolactone-modified dipentaerythritol hexa(meth)acrylate is particularly preferable.

[0035]

In the ultraviolet-curable resin composition of the present invention, these for the (C) component can be used alone or as a mixture of two or more kinds thereof at an arbitrary ratio. The content of the (C) component in the ultraviolet-curable resin composition (the content based on the total amount of the resin composition) is

usually 4 to 80%, preferably 10 to 50% by weight and further preferably 10 to 40% by weight.

Meanwhile, when the urethane (meth)acrylate (C-2) is used in the range of 15 to 35% by weight and preferably 20 to 30% by weight based on the total amount of the resin composition, the above epoxy (meth)acrylate (C-1) or the above (meth)acrylate monomer (C-3) component may be used in combination, and however an aspect in which the (C-2) component is used alone as the (C) component is one of the preferable aspects. In addition, when the (C-2) component is not contained or its content is 25% by weight or less based on the total amount of the resin composition, an aspect in which the above epoxy (meth)acrylate (C-1) or the above (meth)acrylate monomer (C-3) is used as the (C) component is also preferable.

Given the case where the (C-2) component is not contained or its content is small as described above, the content of the (C) component based on the total amount of the resin composition may be also 30 to 80% by weight and preferably 40 to 70% by weight.

In addition, when (C-1) and (C-2) are used in combination as the (C) component, usually (C-1) and/or (C-2) may be also 5 to 50 parts by weight and preferably approximately 10 to 30 parts by weight based on 100 parts by weight of the (C) component, and the rest is the (C-3) component. Further, one of the preferable aspects in the case of using the (C-3) component as the (C) component can also include an aspect in which the (C-3) component is contained at a ratio of 10 to 80 parts by weight, preferably 20 to 80 parts by weight and more preferably approximately 25 to 75 parts by weight based on 100 parts by weight of the (C) component.

In the present invention, one of the more preferable aspects is the case where the (C-2) component is contained as the (C) component in an amount of greater than 0 and 80% by weight or less, preferably 20 to 70% by weight and further preferably 20 to 60% by weight based on the total amount of the resin composition, the (C-1) component or the (C-3) component (more preferably the (C-3) component) is

contained in an amount of 0 to 40% by weight, and the total amount of the (C) component is greater than 0 and 80% by weight or less, preferably 20 to 70% by weight and more preferably 20 to 60% by weight. In addition, one of the preferable aspects in this situation is the case where the content of the (C-2) component based on the total amount of (C) component is approximately 40 to 100% by weight, more preferably 60 to 100% by weight and further preferably 80 to 100% by weight.

Meanwhile, the total amount of the (A) component and the (C) component is preferably 80 to 99% and more preferably 90 to 99% by weight based on the total amount of the resin composition.

[0036]

To the ultraviolet-curable resin composition for an optical disc of the present invention, an additive may be added, such as a rust preventive agent such as mercapto phenol, an antioxidant, an organic solvent, a silane coupling agent, a polymerization inhibitor, a leveling agent, an antistatic agent, a surface lubricant, a fluorescent brightening agent, a light stabilizer (for example, a hindered amine compound and the like) and a filler, according to necessity. Specific examples of the hindered amine compound includes, for example, 1,2,2,6,6-pentamethyl-4-piperidyl alcohol, 2,2,6,6-tetramethyl-4-piperidyl alcohol, 1,2,2,6,6-pentamethyl-4-piperidyl (meth)acrylate (LA-82 manufactured by ADEKA Corporation) and the like.

By addition of a hindered amine compound, mercapto phenol or/and the like, preferable effects are achieved in improvement of durability and the like in some cases.

These additives can be used in the range of usually 0 to 20% by weight and preferably 0 to 10% by weight based on the total amount of the resin composition.

[0037]

In addition, in the present invention, by using the above (A) component and (C) component, preferably either one or both of urethane (meth)acrylate (C-2) or the above (meth)acrylate monomer (C-3) in combination, the elastic modulus of a cured product of the resin composition of the present invention can be also an elastic

modulus (25°C) preferable in the present invention, for example, in the range of 0.01 to 100 MPa, preferably 0.01 to 30 MPa and more preferably 0.01 to 20 MPa. When the elastic modulus of said cured product layer at 25°C is adjusted to this range, an optical disc having said cured product layer on its interface layer is excellent in both durability and recording properties.

The urethane (meth)acrylate (C-2) preferable in this case can include the above preferable urethane (meth)acrylates, and more preferable are the urethane (meth)acrylates listed as the above (C-2a).

Further, the above (meth)acrylate monomer (C-3) can preferably include C5 to C18 alkyl (meth)acrylate, alkylene glycol di(meth)acrylate having 7 to 18 carbon atoms, poly(C2 to C4 alkylene glycol)di(meth)acrylate (where poly is preferably approximately 2 to 20), poly(C2-C3 alkylene oxide)-modified bisphenol A-type di(meth)acrylate (where poly is preferably approximately 2 to 20) and the like, and ethylene oxide 5 to 15 mol-modified (most preferably 10 mol-modified) bisphenol A-type di(meth)acrylate is more preferable.

[0038]

The preferable aspects of the resin composition of the present invention are exemplified as described below.

(I) An ultraviolet-curable resin composition for an optical disc having an organic coloring matter recording layer as a recording layer, which contains (A) poly(tetramethylene glycol)di(meth)acrylate or poly(C2 or C3 alkylene glycol-tetramethylene glycol)di(meth)acrylate as the (meth)acrylate having a structure represented by the above-described general formula (1), (B) a photopolymerization initiator and (C) a (meth)acrylate other than (A).

(II) The ultraviolet-curable resin composition according to the above-described (I), wherein the above-described (A) component is poly(tetramethylene glycol)di(meth)acrylate.

(III) The ultraviolet-curable resin composition according to the above-described (I) or (II), wherein "poly" in the above-described (A) component is in the range of 2 to 30.

(IV) The ultraviolet-curable resin composition according to the above-described (III), wherein "poly" is in the range of 2 to 10.

(V) The ultraviolet-curable resin composition according to the above-described (III), wherein "poly" is in the range of 3 to 10.

(VI) The ultraviolet-curable resin composition according to any one of the above-described (I) to (V), wherein the above-described (C) component is at least one kind selected from the group consisting of epoxy (meth)acrylate (C-1), urethane (meth)acrylate (C-2), and a (meth)acrylate monomer (C-3) other than the above (A), (C-1) and (C-2).

[0039]

(VII) The ultraviolet-curable resin composition according to any one of the above-described (I) to (VI), wherein at least urethane (meth)acrylate (C-2) is contained as the above-described (C) component.

(VIII) The ultraviolet-curable resin composition according to (VI) or (VII), wherein the molecular weight of the urethane (meth)acrylate (C-2) is 400 to 10000.

(IX) The ultraviolet-curable resin composition according to any one of the above-described (VI) to (VIII), the urethane (meth)acrylate (C-2) is urethane (meth)acrylate obtained by reaction of a polyhydric alcohol, a polyisocyanate and a hydroxy (meth)acrylate compound.

(X) The ultraviolet-curable resin composition according to the above-described (IX), wherein the polyhydric alcohol is polyester polyol or polyether polyol.

(XI) The ultraviolet-curable resin composition according to the above-described (X), wherein the polyhydric alcohol is polyether polyol.

(XII) The ultraviolet-curable resin composition according to the above-described (X) or (XI), wherein the molecular weight of the polyester polyol or the polyether polyol is 200 to 3000.

(XIII) The ultraviolet-curable resin composition according to any one of (X) to (XII), wherein the polyether polyol is poly C2 to C6 alkylene glycol.

(XIV) The ultraviolet-curable resin composition according to any one of the

above-described (IX) to (XIII), wherein the polyisocyanate is diisocyanate.

(XV) The ultraviolet-curable resin composition according to any one of the above-described (IX) to (XIII), wherein the polyisocyanate is isophorone diisocyanate.

(XVI) The ultraviolet-curable resin composition according to any one of the above-described (IX) to (XIII) wherein the hydroxy (meth)acrylate compound is hydroxyethyl (meth)acrylate.

[0040]

(XVII) The ultraviolet-curable resin composition according to any one of the above-described (VI) to (XVI), wherein the (meth)acrylate monomer (C-3) is caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate or (poly) C2 to C4 alkylene oxide-modified C6-C15 glycol di(meth)acrylate.

(XVIII) The ultraviolet-curable resin composition according to any one of the above-described (VI) to (XVI), wherein the (meth)acrylate monomer (C-3) is poly C2 to C4 alkylene oxide-modified bisphenol A-type di(meth)acrylate.

(XIX) The ultraviolet-curable resin composition according to any one of the above-described (I) to (XVIII), wherein the above-described (A) component content is 10 to 95% by weight, the above-described (B) component content is 1 to 10% by weight and the above-described (C) component content is 4 to 89% by weight, based on the total amount of the resin composition.

(XX) The ultraviolet-curable resin composition according to the above-described (XIX), wherein the above-described (A) component content is 20 to 80% by weight and the above-described (C) component content is 10 to 70% by weight.

(XXI) The ultraviolet-curable resin composition according to the above-described (XIX), wherein the above-described (A) component content is 40 to 80% by weight and the above-described (C) component content is 20 to 60% by weight, and the total of the (A) component content and the above-described (C) component content is 90 to 99% by weight.

(XXII) The ultraviolet-curable resin composition according to the above-described (XXI), wherein the above-described (A) component content is 50 to 80% by weight

and the above-described (C) component content is 20 to 50% by weight.

(XXIII) The ultraviolet-curable resin composition according to any one of the above-described (I) to (XXII), the content of the urethane (meth)acrylate (C-2) is greater than 0% and 80% by weight or less based on the total amount of the resin composition.

[0041]

(XXIV) The ultraviolet-curable resin composition according to any one of the above-described (I) to (XXII), wherein the content of the urethane (meth)acrylate (C-2) is greater than 20% and 60% by weight or less based on the total amount of the resin composition.

(XXV) The ultraviolet-curable resin composition according to the above-described (XXIV), wherein the urethane (meth)acrylate (C-2) is contained as the (C) component in an amount of 80 to 100% by weight based on the total amount of the (C) component.

(XXVI) The ultraviolet-curable resin composition according to any one of the above-described (I) to (XXV), wherein an arbitrary additive is contained in an amount of 0 to 20% by weight based on the total amount of the resin composition.

(XXVII) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (I) to (XXVI), wherein the elastic modulus of a cured product at 25°C upon curing is 0.01 to 100 MPa.

(XXVIII) The ultraviolet-curable resin composition for an optical disc according to the above-described (XXVII), wherein the elastic modulus of a cured product at 25°C upon curing is 0.01 to 30 MPa.

(XXIX) The ultraviolet-curable resin composition for an optical disc according to the above-described (XXVII), wherein the elastic modulus of a cured product at 25°C upon curing is 0.01 to 20 MPa.

[0042]

The ultraviolet-curable resin composition for an optical disc of the present invention can be obtained by dissolving and mixing the above components at ordinary

temperature to 80°C, and if necessary, foreign substances may be removed by an operation of filtration or the like. In view of coating properties of the adhesive resin composition of the present invention, it is preferred to appropriately adjust the mixing ratio and the like of the components so that the viscosity at 25°C is in the range of 30 to 2000 mPa·s, preferably 50 to 2000 mPa·s and more preferably 80 to 1600 MPa·s. In particular, in the case where the light transmitting layer can be only one layer of a cured product layer of the resin composition of the present invention, approximately 500 to 1600 MPa·s is preferable.

Here, too high viscosity leads to difficulty in formation of a thin layer, so it is preferred to appropriately adjust the viscosity in accordance with the film thickness to be formed.

[0043]

The ultraviolet-curable resin composition for an optical disc of the present invention is suitably used as a coating agent for a light transmitting layer on the laser incident side of a Blu-ray disc or the like. Specifically, an optical disc substrate is coated with the resin composition of the present invention by an arbitrary method, for example, a spin coating method, a 2P method, a roll coating method, a screen printing method and the like so that the film thickness of the resin coated is 1 to 100 μm and preferably 10 to 100 μm . Preferably, for an optical disc substrate having an organic coloring matter recording layer and an interface layer formed thereon, said interface layer is coated. After coating, irradiation with an ultraviolet to near ultraviolet (wavelength of around 200 to 400 nm) ray is carried out from one side or both sides for curing. The irradiation dose is preferably about 50 to 1500 mJ/cm² and particularly preferably approximately 100 to 1000 mJ/cm². For curing by irradiation with an ultraviolet to near ultraviolet ray, any light source may be used as long as it is a lamp for irradiation with an ultraviolet to near ultraviolet ray. For example, it includes a low pressure, a high pressure or ultrahigh pressure mercury lamp, a metal halide lamp, a (pulse) xenon lamp, an electrodeless lamp or the like.

[0044]

When a light transmitting layer comprises a first resin layer formed on a recording layer or an interface layer formed thereon and a second resin layer formed on the opposite side of the recording layer or the interface layer from the first resin layer, the ultraviolet-curable resin composition of the present invention can be suitably used for the above first resin layer.

In this case, the thickness of the above first resin layer is usually 1 μm to 50 μm , preferably 5 μm to 40 μm and more preferably 10 μm to 30 μm .

Meanwhile, the thickness of the above second resin layer is usually 50 μm to 100 μm , preferably 60 μm to 95 μm and more preferably 70 μm to 90 μm .

[0045]

For a method for forming a light transmitting layer (protective layer) in the case where the light transmitting layer (protective layer) comprises two layers, an optical disc substrate is coated with the composition by an arbitrary method, for example, a spin coating method, a 2P method, a roll coating method, a screen printing method or the like so that specifically the film thickness of the coated resin as the first resin layer (the resin composition layer of the present invention) is, for example, 1 μm to 50 μm , preferably 1 to 30 μm and more preferably 10 μm to 30 μm . After coating, irradiation with an ultraviolet to near ultraviolet (wavelength of around 200 to 400 nm) ray is carried out from one side or both sides for curing. The irradiation dose is preferably 50 to 1500 mJ/cm^2 and particularly preferably approximately 100 to 1000 mJ/cm^2 . After curing the first resin layer, the optical disc substrate is coated with a resin composition for a light transmitting layer which is different from the resin composition of the present invention by an arbitrary method, for example, a spin coating method, a 2P method, a roll coating method, a screen printing method or the like so that the film thickness of the second resin layer is, for example, 50 μm to 100 μm , preferably 70 to 100 μm and more preferably 70 μm to 90 μm . After coating, irradiation with an ultraviolet to near ultraviolet (wavelength of around 200 to 400 nm) ray is carried out from one side or both sides for curing. The irradiation dose is preferably about 50 to 1500 mJ/cm^2 and particularly preferably approximately 100 to 1000 mJ/cm^2 . In this

regard, for curing by irradiation with an ultraviolet to near ultraviolet ray, any light source may be used as long as it is a lamp for irradiation with an ultraviolet to near ultraviolet ray. It includes, for example, a low pressure, a high pressure or ultrahigh pressure mercury lamp, a metal halide lamp, a (pulse) xenon lamp, an electrodeless lamp or the like.

In addition, the resin composition of the present invention also allows a light transmitting layer to be formed of one layer of a cured product layer of the resin composition of the present invention. Formation of said cured product layer can be also carried out in accordance with the formation of the first layer with the above-described resin composition of the present invention, except that the film thickness is 50 μm to 100 μm and preferably 70 to 100 μm and a second layer is not formed.

The light transmitting layer formed of a cured product of the resin composition of the present invention is excellent in light transmittance around 400 nm and suitable as a light transmitting layer for a Blu-ray disc.

[0046]

A preferable optical disc of the present invention obtained as described above is an optical disc having, at least, a plastic supporting substrate having a guide groove such as carbonate, a reflecting layer formed on said guide groove, a recording layer {inorganic or organic recording layer, preferably organic coloring matter (usually azo coloring matter or the like) recording layer} formed on said reflecting layer, an interface layer (dielectric layer) formed on said recording layer, and a cured product layer (light transmitting layer) of the resin composition of the present invention which is formed on said interface layer. The light transmitting layer may be formed as a single layer of a cured product layer (light transmitting layer) of the resin composition of the present invention alone in some cases, or it may have a further cured product layer of another resin composition for a light transmitting layer on the cured product layer of the resin composition of the present invention. In the latter case, The light transmitting layer is formed of two layers of a cured product layer of the resin

composition of the present invention and a cured product layer of another resin composition for a light transmitting layer.

In the optical disc of the present invention, preferable effects of the present Invention are achieved when a cured product layer of the resin composition of the present invention is formed directly on an interface layer formed on a recording layer {preferably, recording layer containing an organic coloring matter (usually azo coloring matter or the like)}.

In particular, an optical disc having a cured product layer of the resin composition according to any one of the above preferable aspects (I) to (XXIX), particularly a Blu-ray disc having an organic coloring matter recording layer, shows very excellent jitter values before and after durability test and has high reliability even in use for a long period of time in recording and under high temperature and high humidity.

[0047]

The interface layer is, as well known in those skilled in the art, a layer formed of a metal atom-containing inorganic compound such as a complex containing a metal atom such as Zn.

In this regard, the recording layer in the optical disc of the present invention means a recording layer capable of being written by laser light.

In the optical disc of the present invention, the recording information surface of the substrate is provided with a recording layer. For said recording layer, a material conventionally known as a recording layer for an optical recording medium can be appropriately utilized. For example, it includes a coloring matter, an amorphous semiconductor, a partial nitride film, a partial oxide film (inorganic film) and the like.

The optical recording medium of the present invention may have a plurality of recording layers, and in this case, the layers may be formed of the same material or different materials in arbitrary combination. This allows each layer to have different optical properties such as a transmittance ratio.

Specific examples of the amorphous semiconductor material to be used in the

recording layer include SbTe-based, GeTe-based, GeSbTe-based, InSbTe-based, AgSbTe-based, AgInSbTe-based, GeSb-based, GeSbSn-based, InGeSbTe-based, InGeSbSnTe-based and the like materials. Among these, it is preferred to use a composition whose main component is Sb in order to increase the crystallization speed. In this regard, one kind of these amorphous semiconductor materials may be used alone, or two or more kinds thereof may be used in arbitrary combination and at an arbitrary ratio.

Specific examples of the partial nitride film and the partial oxide film include a partial nitride film such as BiGeN and SnNbN and a partial oxide film such as TeOx and BiFOx.

Examples

[0048]

Hereinafter, the present invention will be more specifically explained with reference to Examples, but the present invention is not limited to these Examples.

Examples 1 to 3 and Comparative Examples 1 and 2

Each ultraviolet-curable resin composition of Examples 1 to 3 and Comparative Examples 1 and 2 was prepared by uniformly mixing the components according to the composition shown in Table 1.

[0049]

Table 1

	Example 1	Example 2	Example 3	Comparative Example 1	Comparative Example 2
Component (A)					
ADT-250	65				
A-PTMG-65		75	55		
TPGDA				65	
FA-124AS					65
Component (B)					
IRGACURE-184	4	4	4	4	4
Component (C)					
UA-1	30		40	30	30
BPE-10		20			
Other component					
LA-82	0.5	0.5	0.5	0.5	0.5
PMP	0.5	0.5	0.5	0.5	0.5
Jitter value (%) before durability test	6.2	6.4	6.2	11.8	12.5
judgment	O	O	O	×	×
Jitter value (%) after durability test	8.5	8.8	8.0	14.0	15.1
Judgment	O	O	O	×	×
Elastic modulus (MPa) 25°C/1Hz	100	28	17	1200	1600

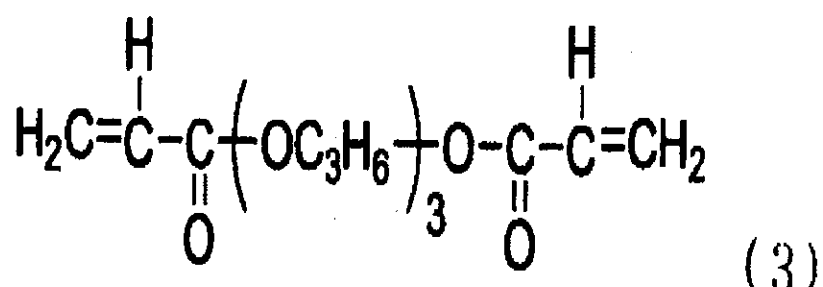
[0050]

In this regard, the components shown in abbreviation in Table 1 are as described below.

A-PTMG-65: polytetramethylene glycol diacrylate (compound of the formula (2) wherein R is a hydrogen atom and n = 9; manufactured by Shin-Nakamura Chemical Co., Ltd.)

ADT-250: polytetramethylene glycol diacrylate (compound of the formula (2) wherein R is a hydrogen atom and n = 3; manufactured by NOF corporation)

TPGDA: tripropylene glycol diacrylate (compound of the formula (3); manufactured by Sartomer Co.)



FA-124AS: 1,4-butanediol diacrylate (compound of the formula (2) wherein R is a hydrogen atom and n = 1; manufactured by Hitachi Chemical Co., Ltd.)

UA-1: urethane acrylate (urethane acrylate obtained by reacting 3 components of polytetramethylene glycol (molecular weight 850), isophorone diisocyanate, 2-hydroxyethyl acrylate at a molar ratio of 1:2:2)

BPE-10: ethylene oxide 10 mol-modified bisphenol A-type diacrylate (manufactured by Dai-ichi Kogyo Seiyaku Co., Ltd.)

LA-82: 1,2,2,6,6-pentamethyl-4-piperidyl methacrylate (manufactured by ADEKA Corporation)

PMP: 4-mercapto phenol

[0051]

Using each obtained ultraviolet-curable resin composition of the present invention, a Blu-ray disc having a coloring matter recording layer was made by the method described in (i) or (ii) below, evaluation of recording properties of the obtained Blu-ray disc was carried out by the method described (iii) below, and the results are

shown in the above Table 1. In addition, measurement of the elastic modulus of each cured product of the resin composition of the present invention was carried out by the method described in (iv) below, and the results are shown in the above Table 1.

[0052]

(i) Making a Blu-ray disc using each resin composition of Examples 1 and 2

(Blu-ray disc with a light transmitting layer having a coloring matter recording layer composed of two layers of a resin cured product layer of the present invention and a cured layer of another resin composition for a light transmitting layer)

1. On a polycarbonate substrate having a guide groove with a 0.32 μm track pitch, a diameter of 12 cm and a thickness of 1.1 mm, a silver alloy was sputtered so that the film thickness was 100 nm, and a reflecting layer was thus formed. After that, a coloring matter solution dissolving an azo coloring matter in a TFP (tetrafluoropropanol) solvent was coated by a spin coating method and dried at 80°C for 30 minutes to form a coloring matter recording layer. Further, ZnS-SiO₂ (molar ratio of 80:20) was sputtered so that the thickness was about 15 nm and an interface layer was thus formed, and a Blu-ray disc substrate was manufactured.

2. The Blu-ray disc substrate was put on a spin table with the interface layer being upside, circular cap treatment was carried out to cover the internal diameter of 11.5 mm, and then 2.0 g of an ultraviolet-curable resin composition of the present invention were supplied on the cap in the central part.

3. According to the viscosity of the ultraviolet-curable resin composition of the present invention, spin coating was carried out in the speed range of 1000 rpm to 1500 rpm for 4 seconds to 7 seconds so that the coated film thickness was 25 μm . Just before the end of spin coating, 2 shots of irradiation from a xenon flashlamp was carried out to cure to the extent of no flowability on the surface.

4. Using a high-pressure mercury lamp, irradiation was carried out from the upper side at 400 mJ/cm² for 3 seconds to completely cure the ultraviolet-curable resin composition of the present invention.

5. The substrate was put on a spin table with the cured ultraviolet-curable resin composition of the present invention being upside, circular cap treatment was carried out to cover the internal diameter of 11.5 mm, and then 3.0 g of BRD-864 (resin for a light transmitting layer for a Blu-ray disc, manufactured by Nippon Kayaku Co., Ltd.) were supplied on the cap in the central part.

6. Spin coating was carried out in the speed range of 1500 rpm for 4 seconds to 7 seconds so that the coated film thickness is 75 μm . Just before the end of spin coating, 2 shots of irradiation from a xenon flashlamp were carried out to cure to the extent of no flowability of the surface.

7. Using a high-pressure mercury lamp, irradiation was carried out from the upper side at 400 mJ/cm^2 for 3 seconds to completely cure the BRD-864, and a Blu-ray disc of the present invention was thus manufactured.

[0053]

(ii) Blu-ray disc using the resin composition of Example 3

(Blu-ray disc with a light transmitting layer having a coloring matter recording layer composed of a resin cured product layer of the present invention alone)

1. On a polycarbonate substrate having a guide groove with a 0.32 μm track pitch, a diameter of 12 cm and a thickness of 1.1 mm, a silver alloy was sputtered so that the film thickness is 100 nm, and a reflecting layer was thus formed. After that, a coloring matter solution dissolving an azo coloring matter in a TFP (tetrafluoropropanol) solvent was coated by a spin coating method and dried at 80°C for 30 minutes to form an organic coloring matter recording layer. Further, ZnS-SiO_2 (molar ratio of 80:20) was sputtered so that the thickness was about 15 nm and an interface layer was thus formed, and a Blu-ray disc substrate was manufactured.

2. The Blu-ray disc substrate was put on a spin table with the interface layer being upside, circular cap treatment was carried out to cover the internal diameter of 11.5 mm, and then 2.0 g of the ultraviolet-curable resin composition of the present invention were applied on the cap in the central part.

3. According to the viscosity of the ultraviolet-curable resin composition of the present

invention, spin coating was carried out in the speed range of 800 rpm to 1300 rpm for 4 seconds to 7 seconds so that the thickness of the coated film after curing was 100 μm . Just before the end of spin coating, 2 shots of irradiation from a xenon flashlamp were carried out to cure to the extent of no flowability of the surface.

4. Using a high-pressure mercury lamp, irradiation was carried out from the upper side at a light amount of 400 mJ/cm^2 for 3 seconds to completely cure the ultraviolet-curable resin composition of the present invention, and a Blu-ray disc of the present invention was thus manufactured.

[0054]

(iii) Recording signal characteristics of Blu-ray disc before and after durability test

The optical disc of the present invention was left under the circumstances of 80°C and 85% RH for 250 hours. Using a Blu-ray disc data signal measuring device: ODU-1000 manufactured by Pulstec Industrial Co., Ltd., recording was carried out at a linear velocity of 4.92 m/s, a reproducing power of 0.30 mW, a recording power of 6.0 mW and T continuous recording (1 T length = 0.08 μm), and recording signal characteristics (jitter value) of the Blu-ray discs were measured before and after durability test and then evaluated in accordance with the below-described criteria. The jitter value is one of the electric signals of an optical disc, a higher numerical value means more deterioration of signal data in a Blu-ray disc, and 10% or more leads to difficulty in reading and writing data.

Evaluation of jitter value

O···Jitter value is less than 10.0%.

X···Jitter value is 10.0% or more.

[0055]

(iv) Measurement of elastic modulus of resin cured product layer of the present invention

The elastic modulus was measured in accordance with Dynamic Viscoelastic Measurement based on JIS K 7244-5. That is, a coating film was formed of the resin composition of the present invention so that the thickness after curing was 1 mm, and

cured at an integrated light amount of 1 J/cm² using a Fusion lamp D bulb, and then a sample piece having a length of 5 cm, a width of 1 cm, and a thickness of 1 mm was made, and the measurement was carried out by a viscoelasticity measuring device DMS 6100 manufactured by SII NanoTechnology Inc. The measurement was carried out in bending mode and in the range of -50°C to 200°C under the conditions of an amplitude load of 10 mN, a frequency of 1 Hz and a temperature rising rate of 2°C/ minute.

(v) Measurement of transmittance of Blu ray (light around 400 nm)

Using each resin composition obtained in the above-described Examples 1 to 3, each sample having a film thickness after curing of 100 µm for light transmittance measurement was made, and using a spectrophotometer (U-3310, manufactured by Hitachi High-Technologies Corporation), the absorbance of light at 405 nm for each sample was measured to determine the light transmittance. Any of the samples had a light transmittance of 85% or more.

[0056]

From the results in Table 1, it is found that the resin compositions of the present invention of Examples 1 and 2 which contain a (meth)acrylate having a structure represented by the general formula (1) had good recording signal characteristics before and after the durability test. On the other hand, Comparative Example 1 containing a compound of the formula (3) and Comparative Example 2 containing a compound of the formula (2) wherein R is a hydrogen atom and n = 1 did not have good recording signal characteristics before and after the durability test.

Industrial Applicability

[0057]

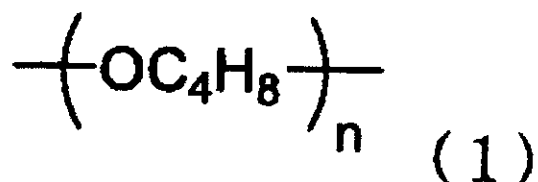
When the resin composition of the present invention is used as a resin composition for a light transmitting layer of an optical disc, a cured product layer obtained therefrom is excellent in transmission of light around 400 nm of a blu ray and an optical disc obtained therefrom has excellent recording signal characteristics and

also excellent durability, so the resin composition of the present invention and the optical disc of the present invention, particularly the optical disc having an organic coloring matter recording layer, are useful for manufacturing an optical disc such as Blu-ray disc.

Claims

1. An optical disc having a cured product layer of an ultraviolet-curable resin composition containing (A) a (meth)acrylate having a structure represented by the below-described general formula (1) (however, except for butanediol (meth)acrylate), (B) a photopolymerization initiator and (C) a (meth)acrylate other than the above-described (A), and a recording layer:

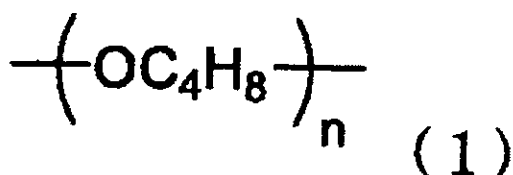
Formula (1)



wherein, n represents an integer number of 1 to 30.

2. An ultraviolet-curable resin composition for an optical disc having a recording layer, which contains (A) a (meth)acrylate having a structure represented by the below-described general formula (1) (however, except for butanediol (meth)acrylate), (B) a photopolymerization initiator and (C) a (meth)acrylate other than the above-described (A):

Formula (1)



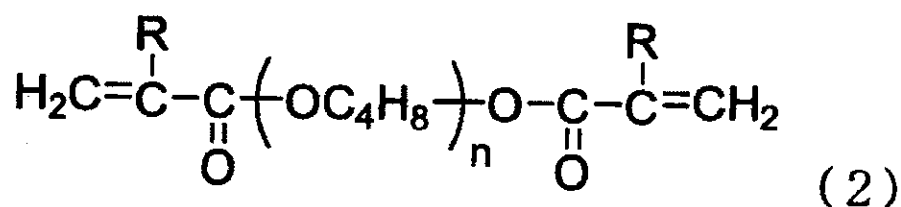
wherein, n represents an integer number of 1 to 30.

3. The ultraviolet-curable resin composition for an optical disc according to Claim 2, wherein the (A) (meth)acrylate having a structure represented by the general formula (1) (however, except for butanediol (meth)acrylate) is poly(tetramethylene glycol)di(meth)acrylate or poly(C2 or C3 alkylene glycol-tetramethylene

glycol)di(meth)acrylate.

4. The ultraviolet-curable resin composition for an optical disc according to Claim 2, wherein the above (meth)acrylate (A) is a (meth)acrylate having a structure represented by the below-described general formula (2):

Formula (2)



wherein, R represents a hydrogen atom or a methyl group, and n represents an integer number of 2 to 10.

5. The ultraviolet-curable resin composition for an optical disc according to Claim 2, wherein the above (meth)acrylate (A) is contained in an amount of 20 to 95% by weight based on the whole composition.

6. The ultraviolet-curable resin composition for an optical disc according to Claim 2, wherein the (meth)acrylate (C) other than (A) is at least one kind selected from the group consisting of epoxy (meth)acrylate (C-1), urethane (meth)acrylate (C-2), and a (meth)acrylate monomer (C-3) other than the above (A), (C-1) and (C-2).

7. The ultraviolet-curable resin composition for an optical disc according to Claim 2, wherein the (meth)acrylate (C) other than (A) is either one or both of urethane acrylate or polyethylene oxide-modified bisphenol A-type diacrylate obtained by reaction polyester polyol or polyether polyol with polyisocyanate and 2-hydroxyethyl acrylate.

8. The ultraviolet-curable resin composition for an optical disc according to Claim 2,

wherein the content of the above (meth)acrylate (A) is 20 to 95% by weight and the content of the (B) photopolymerization initiator is 1 to 10% by weight based on the whole composition, and the rest is the (meth)acrylate (C) other than (A).

9. The ultraviolet-curable resin composition for an optical disc according to Claim 2, wherein the elastic modulus of the cured product at 25°C upon curing is 0.01 to 100 MPa.

10. A cured product obtained by irradiating the ultraviolet-curable resin composition according to any one of Claims 2 to 9 with an active energy ray.

11. The method for manufacturing the optical disc according to Claim 1, which is characterized in that an optical disc substrate having a recording layer is coated with the ultraviolet-curable resin composition according to any one of Claims 2 to 9 and irradiated with an active energy ray to form a cured product layer of said resin composition on said optical disc substrate.

12. Use of the ultraviolet-curable resin composition according to any one of Claims 2 to 9 for forming a light transmitting layer in an optical disc having a recording layer.

13. The optical disc according to Claim 1, which has an organic coloring matter recording layer.

14. The ultraviolet-curable resin composition according to any one of Claims 2 to 9, wherein the optical disc is an optical disc having an organic coloring matter recording layer.

15. The ultraviolet-curable resin composition according to any one of Claims 2 to 9 and 14, wherein as the (meth)acrylate (C) other than the above-described (A), the

urethane (meth)acrylate (C-2) is contained in an amount of 20 to 60% by weight based on the total amount of the resin composition.