

DESCRIPTION

OPTICAL DISC HAVING ORGANIC COLORING MATTER RECORDING LAYER,
AND ULTRAVIOLET-CURABLE RESIN COMPOSITION FOR THE SAME

Technical Field

[0001]

The present invention relates to an optical disc having an organic coloring matter recording layer and an ultraviolet-curable resin composition useful for the same.

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, by way of example, a disc having a structure in which a reflecting layer, a recording layer and an interface layer (also called 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 called 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, a 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 in the interface region facing the recording layer is 40 MPa or less at 25°C 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 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 as described above, 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

Disclosure of the Invention

Problems to Be Solved by the Invention

[0007]

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

Means of Solving the Problems

[0008]

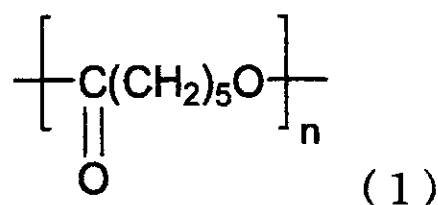
The present inventors have intensively studied to solve the above problems and found that an ultraviolet-curable resin composition containing a (meth)acrylate having a certain structure exhibits excellent recording signal characteristics and durability in an optical disc having an organic coloring matter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

[0009]

That is, the present invention relates to the following (1) to (32).

(1) An optical disc having an interface layer on an organic coloring matter recording layer and having a cured product layer of an ultraviolet-curable resin composition (hereinafter, referred to simply as resin composition) containing:

(A) a (meth)acrylate (however, except for urethane (meth)acrylate) having a structure shown by the following the formula (1):



(wherein, n denotes an integer number of 1 to 10)

and

(B) a photopolymerization initiator,
on the interface layer.

(2) The optical disc according to the above-described (1), wherein the (meth)acrylate (A) having a structure shown by the formula (1) is at least one kind selected from the group consisting of caprolactone-modified hydroxyethyl (meth)acrylate, caprolactone-modified hydroxybutyl (meth)acrylate, caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate, caprolactone-modified tris(acryloxyethyl)isocyanurate and caprolactone-modified dipentaerythritol hexa(meth)acrylate.

(3) The optical disc according to the above-described (1) or (2), wherein the above resin composition is an ultraviolet-curable resin composition further containing a (meth)acrylate (C) other than (A).

[0010]

(4) The optical disc according to any one of the above-described (1) to (3), wherein the (meth)acrylate (A) having a structure shown by the formula (1) is contained in an amount of 20 to 95% by weight based on the above whole resin composition.

(5) The optical disc according to the above-described (3) or (4), wherein the above (meth)acrylate (C) is at least one kind selected from the group consisting of: urethane acrylate as a reactant of polyester polyol or polyether polyol with polyisocyanate and 2-hydroxyethyl acrylate; and polyethylene oxide-modified bisphenol A-type diacrylate.

(6) The optical disc according to the above-described (3) or (4), wherein at least one

kind selected from the group consisting of a (meth)acrylate monomer (c-3a) in Group (I) described below and a (meth)acrylate monomer (c-3b) in Group (II) described below is contained as the above (meth)acrylate (C):

Group (I) (c-3a):

- (i) C5 to C18 alkyl (meth)acrylate, or alkylene glycol di(meth)acrylate having 7 to 18 carbon atoms;
 - (ii) propylene oxide-modified mono- or di(meth)acrylate;
 - (iii) polyethylene oxide-modified bisphenol A-type di(meth)acrylate;
 - (iv) polyethylene oxide-modified phenol acrylate; or
 - (v) (meth)acrylate having a polytetramethylene glycol structure,
- and

Group (II) (c-3b):

dicyclopentenyl oxyethyl (meth)acrylate (or dicyclopentadiene oxyethyl (meth)acrylate), 1,6-hexanediol di(meth)acrylate, dipropylene glycol di(meth)acrylate or tripropylene glycol di(meth)acrylate.

[0011]

(7) The optical disc according to the above-described (6), a (meth)acrylate monomer (c-3a) in the above-described Group (I) is contained as the above (meth)acrylate (C).

(8) The optical disc according to the above-described (7), wherein a C5 to C18 alkyl (meth)acrylate is contained as the (meth)acrylate monomer (c-3a) in the above-described Group (I).

(9) The optical disc according to the above-described (6), wherein a (meth)acrylate monomer (c-3b) in the above-described Group (II) is contained as the above (meth)acrylate (C).

(10) The optical disc according to any one of the above-described (3) to (9), wherein a urethane (meth)acrylate (C-2) is contained as the above (meth)acrylate (C).

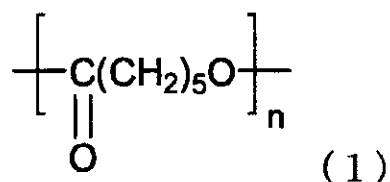
(11) The optical disc according to the above-described (10), wherein the above urethane (meth)acrylate (C-2) is a urethane (meth)acrylate obtained by reaction of a poly C2 to C6 alkylene glycol, isophorone diisocyanate and a hydroxy C2 to C4

(meth)acrylate.

(12) The optical disc according to any one of the above-described (1) to (11), wherein the above resin composition is a resin composition further containing a hindered amine compound (D).

(13) A method for manufacturing an optical disc, which comprises a process of coating an ultraviolet-curable resin composition containing at least

(A) a (meth)acrylate having a structure shown by the following formula (1):



(wherein, n denotes an integer number of 1 to 10)

and

(B) a photopolymerization initiator,

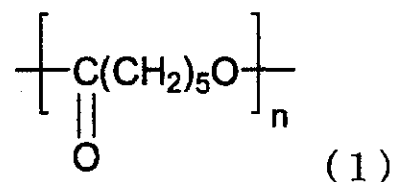
on an interface layer which an optical disc substrate has on an organic coloring matter recording layer, and subsequently said coated film is irradiated with an active energy ray to form a cured product layer.

(14) The method for manufacturing an optical disc according to the above-described (13), wherein the ultraviolet-curable resin composition is an ultraviolet-curable resin composition further containing a (meth)acrylate (C) other than (A).

[0012]

(15) An ultraviolet-curable resin composition for an optical disc containing

(A) a (meth)acrylate (however, except for urethane (meth)acrylate) having a structure shown by the following formula (1):



(wherein, n denotes an integer number of 1 to 10)

and

(B) a photopolymerization initiator.

(16) The ultraviolet-curable resin composition for the optical disc according to the above-described (15), wherein the (meth)acrylate (A) having a structure shown by the formula (1) is at least one kind selected from the group consisting of caprolactone-modified hydroxyethyl (meth)acrylate, caprolactone-modified hydroxybutyl (meth)acrylate, caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate, caprolactone-modified tris(acryloxyethyl)isocyanurate and caprolactone-modified dipentaerythritol hexa(meth)acrylate.

(17) The ultraviolet-curable resin composition for the optical disc according to the above-described (15) or (16), which further contains a (meth)acrylate (C) other than the above-described (A).

(18) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (15) to (17), wherein the (meth)acrylate (A) having a structure shown by the formula (1) is contained in an amount of 20 to 95% by weight based on the above whole resin composition.

(19) The ultraviolet-curable resin composition for an optical disc according to the above-described (17) or (18), wherein the above (meth)acrylate (C) is at least one kind selected from the group consisting of: urethane acrylate as a reactant of polyester polyol or polyether polyol with polyisocyanate and 2-hydroxyethyl acrylate; and polyethylene oxide-modified bisphenol A-type diacrylate.

[0013]

(20) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (17) to (19), wherein at least one kind selected from the group consisting of a (meth)acrylate monomer (c-3a) in Group (I) described below and a (meth)acrylate monomer (c-3b) in Group (II) described below is contained as the above (meth)acrylate (C),

Group (I) (c-3a):

(i) C5 to C18 alkyl (meth)acrylate, or alkylene glycol di(meth)acrylate having 7 to 18

carbon atoms;

- (ii) propylene oxide-modified mono- or di(meth)acrylate;
- (iii) polyethylene oxide-modified bisphenol A-type di(meth)acrylate;
- (iii) polyethylene oxide-modified phenol acrylate;
- (iv) (meth)acrylate having a polytetramethylene glycol structure;

Group (II) (c-3b):

dicyclopentenyl oxyethyl (meth)acrylate (or dicyclopentadiene oxyethyl (meth)acrylate), 1,6-hexanediol di(meth)acrylate, dipropylene glycol di(meth)acrylate or tripropylene glycol di(meth)acrylate.

(21) The ultraviolet-curable resin composition for an optical disc according to the above-described (20), wherein a (meth)acrylate monomer (c-3a) in the above-described Group (I) is contained as the above (meth)acrylate (C).

(22) The ultraviolet-curable resin composition for an optical disc according to the above-described (21), wherein a C5 to C18 alkyl (meth)acrylate is contained as the (meth)acrylate monomer (c-3a) in the above-described Group (I).

(23) The ultraviolet-curable resin composition for the optical disc according to the above-described (20) or (21), wherein the content of the (meth)acrylate monomer (c-3a) in the above-described Group (I) is 20 to 60% by weight based on the total amount of the resin composition.

(24) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (20) to (23), wherein a (meth)acrylate monomer (c-3b) in the above-described Group (II) is contained as the above (meth)acrylate (C).

[0014]

(25) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (17) to (24), wherein a urethane (meth)acrylate (C-2) is contained as the above (meth)acrylate (C).

(26) The ultraviolet-curable resin composition for the optical disc according to the above-described (25), wherein said urethane (meth)acrylate (C-2) is a urethane (meth)acrylate obtained by reaction of a poly C2 to C6 alkylene glycol, isophorone

diisocyanate and a hydroxy C2 to C4 (meth)acrylate.

(27) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (17) to (26), wherein at least one kind selected from the group consisting of a C5 to C18 alkyl (meth)acrylate, polyethylene oxide 5 to 15 mol-modified bisphenol A-type di(meth)acrylate, dicyclopentadiene oxyethyl (meth)acrylate and polypropylene glycol di(meth)acrylate is contained as the (C) component and the content is 50% to 100% based on the total amount of the (C) component.

(28) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (17) to (27), wherein the (A) component and at least one kind selected from the group consisting of urethane (meth)acrylate (C-2), a (meth)acrylate monomer (c-3a) in the above Group (I) and a (meth)acrylate monomer (c-3b) in the above Group (II) as the above (meth)acrylate (C) are contained and the total amount of the (A) component, the (C-2) component, the (c-3a) component and the (c-3b) component is 70 to 99% by weight based on the total amount of the resin composition.

(29) The ultraviolet-curable resin composition for the optical disc according to the above-described (28), wherein at least one kind selected from the group consisting of a (meth)acrylate monomer (c-3a) in the above Group (I) and a (meth)acrylate monomer (c-3b) in the above Group (II) is contained.

(30) The ultraviolet-curable resin composition for the optical disc according to the above-described (28), wherein (i) the (A) component is caprolactone-modified hydroxyethyl (meth)acrylate or (ii) a (meth)acrylate monomer (c-3a) in the above Group (I) is contained, when the urethane (meth)acrylate (C-2) is contained.

(31) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (15) to (30), wherein a hindered amine compound (D) is further contained.

(32) The ultraviolet-curable resin composition for an optical disc according to any one of the above-described (17) to (31), wherein the elastic modulus at 25°C of a cured

product upon curing is 0.01 to 9.5 MPa.

Effect of the Invention

[0015]

The optical disc of the present invention having a cured product layer of the ultraviolet-curable resin composition of the present invention on an interface layer (dielectric layer) laminated directly on an organic coloring matter recording layer has a low jitter value before and after endurance test and high reliability in recording and reproducing even in use for long hours under high temperature and high humidity, and it is easy to manufacture.

Mode for Carrying Out the Invention

[0016]

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

[0017]

The (meth)acrylate (A) having a structure shown by the formula (1) which is contained in the resin composition of the present invention is preferably a monomer, and any monomer with n in the range of 1 to 10 can be used without being limited. The preferable n value is 2 to 7 and more preferably 4 to 6.

In the (meth)acrylate (A) having a structure of said formula (1) which is used in the present invention, an oligomer having said caprolactone-modified structure, for example, a urethane acrylate having the caprolactone-modified structure is not contained.

As a specific compound of the (meth)acrylate (A) having a structure of the above-described formula (1), for example, caprolactone-modified hydroxyethyl (meth)acrylate (for example, SR-495 manufactured by Sartomer Company, Inc.),

caprolactone-modified hydroxybutyl (meth)acrylate, caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate (for example, KAYARAD^{RTM} HX-220 and HX-620 manufactured by Nippon Kayaku Co., Ltd.), caprolactone-modified tris(acryloxyethyl)isocyanurate (for example, NKester A-9300-1CL, A-9300-3CL and A-9300-6CL manufactured by Shin-Nakamura Chemical Co., Ltd.) and caprolactone-modified dipentaerythritol hexa(meth)acrylate (for example, KAYARAD^{RTM} DPCA-20, DPCA-30, DPCA-60 and DPCA-120 manufactured by Nippon Kayaku Co., Ltd.) are preferable.

[0018]

The content of the (A) component in the ultraviolet-curable resin composition is usually 10 to 95% by weight, preferably 20 to 95% by weight, more preferably 30 to 95% by weight and further preferably 40 to 95% by weight, based on the total amount of said resin composition. In some cases, 20 to 80% by weight are preferable. A too low content thereof cannot help volume change of the coloring matter and leads to a lower jitter value (%) as an index of recording signal characteristics.

[0019]

The photopolymerization initiator (B) contained in the composition of the present invention is not particularly limited. It can include, for example, 1-hydroxycyclohexylphenyl ketone (IRGACURE^{RTM} 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^{RTM} 2959; manufactured by CIBA Speciality Chemicals), 2-hydroxy-1-[4-[4-(2-hydroxy-2-methyl-propionyl)-benzyl]-phenyl]-2-methyl-propan-1-one (IRGACURE^{RTM} 127; manufactured by CIBA Speciality Chemicals), 2,2-dimethoxy-2-phenylacetophenone (IRGACURE^{RTM} 651; manufactured by CIBA Speciality Chemicals), 2-hydroxy-2-methyl-1-phenyl-propan-1-one (DAROCUR^{RTM} 1173; manufactured by CIBA Speciality Chemicals), 2-methyl-1-[4-(methylthio)phenyl]-2-morpholinopropan-1-one (IRGACURE^{RTM} 907;

manufactured by Ciba Specialty Chemicals), 2-benzyl-2-dimethylamino-1-(4-morpholinophenyl)-butan-1-one, 2-chlorothioxanthone, 2,4-dimethylthioxanthone, 2,4-diisopropylthioxanthone, isopropylthioxanthone, 2,4,6-trimethylbenzoyldiphenylphosphineoxide, bis(2,4,6-trimethylbenzoyl)-phenylphosphine oxide, bis(2,6-dimethoxybenzoyl)-2,4,4-trimethylpentylphosphineoxide and the like.

In the above, the superscript RTM stands for registered trademark (as is the same hereinafter).

[0020]

In the ultraviolet-curable resin composition of the present invention, these (B) components can be used alone or as a mixture of two or more kinds thereof at any ratio. The content of the (B) component in the ultraviolet-curable resin composition is usually 0.5 to 20% by weight, preferably 1 to 20% by weight and more preferably 1 to 10% by weight, based on the total amount of said resin composition. In this regard, "%" hereinafter represents "% by weight" unless otherwise specifically noted.

[0021]

In addition, an amine and the like which can be a photopolymerization initiating auxiliary can be also 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 is used, the content in the resin composition for adhesion of the present invention is usually 0.005 to 5% by weight and preferably 0.01 to 3% by weight based on the total amount of said resin composition.

[0022]

In the resin composition of the composition of the present invention, it is usually preferred to contain a (meth)acrylate (C) other than the above (A) component. Said (meth)acrylate (C) can include a (meth)acrylate having one or more and usually 1 to 6

(meth)acryloyl groups. The kind is not particularly limited, but (C-1) epoxy (meth)acrylate (hereinafter, also referred to as (C-1) component) and/or (C-2) urethane (meth)acrylate (hereinafter, also referred to as (C-2) component), and further (C-3) a (meth)acrylate monomer (hereinafter, also referred to as (C-3) component) other than the (A) component, the (C-1) component and the (C-2) component described above and the like can be used.

In this regard, (meth)acrylate in the present invention means methacrylate or acrylate.

[0023]

The epoxy (meth)acrylate (C-1) which can be used in the present invention has functions of improving curing properties and of improving the degree of hardness and the curing rate of the cured product.

In the present invention, said epoxy (meth)acrylate (C-1) can be obtained by reacting a glycidyl ether-type epoxy compound with (meth)acrylic acid.

The glycidyl ether-type epoxy compound to obtain the epoxy (meth)acrylate (C-1) includes diglycidyl ether of glycol described below.

The glycol for the above-described diglycidyl ether can include bisphenol A or alkylene oxide adducts thereof, bisphenol F or alkylene oxide adducts thereof, hydrogen added bisphenol A or alkylene oxide adducts thereof, hydrogen added bisphenol F or alkylene oxide adducts thereof, ethylene glycol, propylene glycol, neopentyl glycol, butanediol, hexanediol, cyclohexane dimethanol, polypropylene glycol and the like.

[0024]

The above-described epoxy (meth)acrylate (C-1) can be obtained by reaction of a glycidyl ether-type epoxy compound from them with (meth)acrylic acid under, for example, the below-described conditions and by ring-opening addition of the carboxy group of the (meth)acrylic acid to the epoxy group of the epoxy compound.

[0025]

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 based on 1 equivalent of the epoxy group of the glycidyl ether-type epoxy compound. 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 a catalyst such as triphenylphosphine, 2,4,6-tris(dimethylaminomethyl)phenol (TAP), triethanolamine, tetraethyl ammonium chloride and the like, for example. In addition, as a polymerization inhibitor to prevent polymerization in the reaction, para methoxyphenol, methylhydroquinone and the like can be also used for example.

[0026]

In the present invention, as the above-described epoxy (meth)acrylate (C-1), more preferably is bisphenol A-type epoxy (meth)acrylate obtained from a bisphenol A-type epoxy compound. In the present invention, the molecular weight of the epoxy (meth)acrylate (C-1) is preferably 500 to 10000.

[0027]

The above urethane (meth)acrylate (C-2) is obtained by reaction of polyhydric alcohol, polyisocyanate and a hydroxy (meth)acrylate compound. More specifically, it can be obtained by reaction of polyhydric alcohol with polyisocyanate and by reaction of the obtained urethane oligomer with a hydroxy (meth)acrylate compound.

Said urethane (meth)acrylate (C-2) has a function of adjusting the viscosity of the resin composition of the present invention and adjusting the elastic modulus in the cured product, and of improving mechanical properties (reducing warp, distortion and the like) when the cured layer of said resin composition is used as a light transmitting layer.

[0028]

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 an aliphatic polyhydric alcohol having 2 to 10 carbon atoms.

(ii) Polyester polyol obtained by reaction of one kind of aliphatic polyhydric alcohol described in the above-described (i) with a 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 polyhydric alcohol and ϵ -caprolactone.

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

(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, 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.

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

[0029]

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. The preferable hydroxy (meth)acrylate among them is hydroxy C2-C8 aliphatic hydrocarbon (meth)acrylate, more preferably hydroxy C2-C4 alkyl (meth)acrylate and most preferably hydroxyethyl (meth)acrylate.

[0030]

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

The preferable urethane (meth)acrylate (C-2) is a urethane (meth)acrylate obtained using polyester polyol or polyether polyol as the polyhydric alcohol and using 2-hydroxyethyl (meth)acrylate as the hydroxy (meth)acrylate, and more preferably it can include urethane acrylate (c-2a) obtained from the three of polyester polyol or polyether polyol, polyisocyanate and 2-hydroxyethyl acrylate.

In addition, 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 preferable urethane (meth)acrylates.

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

Furthermore, it can be commercially available as UX-0937: polyether-based urethane acrylate (manufactured by Nippon Kayaku Co., Ltd.) and the like. The molecular weight of the urethane (meth)acrylate (C-2) is preferably approximately

400 to 10000.

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

In the resin composition of the present invention, when the urethane (meth)acrylate (C-2) is contained, its content thereof may be more than 0%, usually 50% or less, preferably 40% or less and more preferably 30% or less, and also in some cases, 15% or less, based on the total amount of the resin composition.

[0031]

The (meth)acrylate monomer (C-3) used as the (meth)acrylate (C) other than (A) component, (C-1) component and (C-2) component is not particularly limited and can include the below-described monofunctional or polyfunctional (preferably 2 to 6 functional) (meth)acrylates.

For example, the monofunctional (meth)acrylate ((meth)acrylate having one (meth)acryloyl group) as the (C-3) component can be specifically exemplified by the below-described compounds. It can include:

- (i) C5 to C18 (preferably C7 to C18) alkyl (meth)acrylates such as isooctyl (meth)acrylate, isoamyl (meth)acrylate, lauryl (meth)acrylate, isodecyl (meth)acrylate, stearyl (meth)acrylate, cetyl (meth)acrylate, isomyristyl (meth)acrylate and tridecyl (meth)acrylate;
- (ii) acrylate compounds having a C7 to C10 aliphatic ring such as tricyclodecane (meth)acrylate, isobornyl (meth)acrylate, dicyclopentenyl acrylate (for example, FANCRYL FA-511A, manufactured by Hitachi Chemical Co., Ltd.), dicyclopentenyl oxyethyl acrylate (dicyclopentadiene oxyethyl (meth)acrylate) (for example, FANCRYL FA-512A, manufactured by Hitachi Chemical Co., Ltd.), dicyclopentadiene oxyethyl (meth)acrylate (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.) and 1-adamantyl methacrylate (for example, Adamantate AM manufactured by Idemitsu Kosan Co., Ltd.);

[0032]

(iii) C2 or C3 alkylene oxide-modified (meth)acrylate compounds, such as polypropylene oxide-modified (meth)acrylates such as polypropylene glycol (meth)acrylate, polypropylene oxide-modified nonylphenyl (meth)acrylate and methoxytripropylene glycol (meth)acrylate, or ethylene oxide-modified (meth)acrylates such as ethoxy diethylene glycol (meth)acrylate, ethylene oxide-modified phenoxyated phosphoric acid (meth)acrylate, ethylene oxide-modified butoxyated phosphoric acid (meth)acrylate and ethylene oxide-modified octyloxyated phosphoric acid (meth)acrylate, and the like; and

(iv) in addition, as a monofunctional (meth)acrylate other than the above-described ones, for example, benzyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, morpholine (meth)acrylate, phenyl glycidyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate and the like.

The (meth)acrylate monomer having one (meth)acryloyl group has a function of improving mechanical properties (suppressing warp, distortion and the like) of an optical disc (for example, Blu-ray Disc) where the ultraviolet-curable resin composition of the present invention is formed into a light transmitting layer.

For example, with regard to an optical disc having an organic coloring matter recording layer (for example, Blu-ray Disc), the above-described function is fulfilled in an optical disc where a cured product layer of the ultraviolet-curable resin composition of the present invention is laminated on an interface layer so that it is

directly contacted with said interface layer formed on said organic coloring matter recording layer.

Among the above-described, the C5 to C18 (preferably C7 to C18) alkyl (meth)acrylate has a function of reducing the elastic modulus of the cured product of the resin composition of the present invention, and according to necessity, it can be used in order that the cured product of the resin composition of the present invention has a preferable elastic modulus.

[0033]

The polyfunctional (meth)acrylate monomer in the above-described (meth)acrylate monomer (C-3) can include the below-described (meth)acrylate monomers having 2 to 6 (meth)acryloyl groups.

(i) (Meth)acrylate monomer having 2 (meth)acryloyl groups as the (C-3) component;

It can include cyclohexane-1,4-dimethanol di(meth)acrylate, cyclohexane-1,3-dimethanol di(meth)acrylate, tricyclodecanedimethylol di(meth)acrylate (for example, KAYARAD R-684, tricyclodecanedimethylol diacrylate manufactured by Nippon Kayaku Co., Ltd., and the like), dioxane glycol di(meth)acrylate (for example, KAYARAD R-604, dioxane glycol diacrylate 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, 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, (poly)alkylene oxide-modified bisphenol A-type di(meth)acrylates such as (poly)ethylene oxide or (poly)propylene oxide, ethylene oxide-modified phosphoric acid di(meth)acrylate, and the like.

Among the above-described, polyethylene oxide-modified bisphenol A-type di(meth)acrylate is preferable, and in some cases, ethylene oxide 5 to 15

mol-modified bisphenol A-type di(meth)acrylate is more preferable.

In addition, di(meth)acrylate of a glycol having an alkylene group having 7 to 18 carbon atoms, such as 2-ethyl-2-butyl-propanediol di(meth)acrylate, 1,9-nonanediol di(meth)acrylate and 1,10-decanediol di(meth)acrylate, is also preferable.

These have a function of reducing the elastic modulus of the cured product of the resin composition, and according to necessity, can be used in order that the cured product of the resin composition of the present invention has a preferable elastic modulus.

[0034]

(ii) (Meth)acrylate monomer having 3 (meth)acryloyl groups as the (C-3) component;

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

[0035]

(iii) (Meth)acrylate monomer having 4 (meth)acryloyl groups as the (C-3) component;

It 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.

(iv) (Meth)acrylate monomer having 5 (meth)acryloyl groups as the (C-3) component;

It can include dipentaerythritol penta(meth)acrylate and the like.

(v) (Meth)acrylate monomer having 6 (meth)acryloyl groups as the (C-3) component;

It can include 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 a polyfunctional one having 7 or more (meth)acryloyl groups.

[0036]

Among the above-listed (C-3) components ((meth)acrylate monomers), the (meth)acrylate monomers (c-3a) described in the below-described Group (I) improve recording properties of an obtained optical disc (for example, Blu-ray Disc) in some cases when used together with the above (A) component, so they are one of the preferable (meth)acrylate monomers.

Group (I):

- (i) C5 to C18 alkyl (meth)acrylates such as isooctyl (meth)acrylate, isoamyl (meth)acrylate, lauryl (meth)acrylate, isodecyl (meth)acrylate, stearyl (meth)acrylate, cetyl (meth)acrylate, isomyristyl (meth)acrylate and tridecyl (meth)acrylate, and alkylene glycol di(meth)acrylates having 7 to 18 carbon atoms such as 2-ethyl-2-butyl-propanediol di(meth)acrylate, 1,9-nonanediol di(meth)acrylate and 1,10-decanediol di(meth)acrylate;
- (ii) propylene oxide-modified mono- or di(meth)acrylates such as polypropylene glycol (meth)acrylate, polypropylene glycol di(meth)acrylate, polypropylene oxide-modified nonylphenyl (meth)acrylate, polypropylene oxide-modified neopentyl glycol di(meth)acrylate, polypropylene oxide-modified 1,6-hexanediol di(meth)acrylate, polypropylene oxide-modified bisphenol A-type di(meth)acrylate and methoxytripropylene glycol (meth)acrylate;
- (iii) polyethylene oxide-modified bisphenol A-type di(meth)acrylate, preferably polyethylene oxide 5 to 15 mol-modified bisphenol A-type di(meth)acrylate, and further preferably polyethylene oxide 10 mol-modified bisphenol A-type di(meth)acrylate;

[0037]

- (iv) polyethylene oxide-modified phenol acrylates such as ethylene oxide 2 mol-modified phenol acrylate and ethylene oxide 6 mol-modified phenol acrylate, and

preferably ethylene oxide 2 to 10 mol-modified phenol acrylate;

(v) (meth)acrylates having a polytetramethylene glycol structure, such as poly(ethylene glycol-tetramethylene glycol)diacrylate, poly(propylene glycol-tetramethylene glycol)diacrylate, polytetramethylene glycol diacrylate, poly(ethylene glycol-tetramethylene glycol)dimethacrylate, poly(propylene glycol-tetramethylene glycol)dimethacrylate and polytetramethylene glycol dimethacrylate, and preferably polytetramethylene glycol di(meth)acrylate, or poly (C2 to C3 alkylene glycol-polytetramethylene glycol) di(meth)acrylate (where approximately 2 to 20 are preferable as poly).

[0038]

Among the above-described, propylene oxide-modified mono- or di(meth)acrylate is one of the preferable as the (meth)acrylate monomer (c-3a), and in some cases, it can impart more excellent recording signal characteristics and durability to the Blu-ray Disc of the present invention.

The repeating number of the propylene oxide unit (the number of the modified moles) in said propylene oxide-modified (meth)acrylate is preferably approximately 2 to 15. In the case where the number of the (meth)acryloyl group in the molecule is large, it is preferred that the number of the modified moles in propylene oxide is larger. For example, in the case of 1 (meth)acryloyl group in the molecule, the repeating number of the propylene oxide unit (the number of the modified moles) is preferably 2 or more, and preferably approximately 2 to 10. In the case of 2 (meth)acryloyl groups, the repeating number of the propylene oxide unit is preferably 7 or more, and specifically, preferably approximately 7 to 15.

The preferable propylene oxide-modified (meth)acrylate can include, for example, polypropylene glycol mono- or di(meth)acrylate, polypropylene oxide-modified nonylphenyl (meth)acrylate, methoxytripropylene glycol (meth)acrylate or the like.

[0039]

The polypropylene glycol (meth)acrylate can include, for example,

BLEMMER^{RTM} AP-150 (the repeating number of the propylene glycol unit is 3), AP-400 (the repeating number of the propylene glycol unit is 6), AP-550 (the repeating number of the propylene glycol unit is 9) and the like manufactured by NOF corporation. In addition, the polypropylene glycol di(meth)acrylate includes, for example, FANCRYL^{RTM} FA-P240A (the repeating number of the propylene glycol unit is 7) and FA-P270A (the repeating number of the propylene glycol unit is 12) manufactured by Hitachi Chemical Co., Ltd.; the polypropylene oxide-modified nonylphenyl (meth)acrylate includes, for example, M-117 (the repeating number of the propylene oxide unit is 2.5) manufactured by Toagosei Co., Ltd. and New Frontier^{RTM} NP-5P (the repeating number of the propylene oxide unit is 5) manufactured by Dai-ichi Kogyo Seiyaku Co., Ltd.; and the methoxytripropylene glycol (meth)acrylate includes, for example, NKester AM-30PG (the repeating number of the propylene glycol unit is 3) manufactured by Shin-Nakamura Chemical Co., Ltd., and the like. The polypropylene glycol di(meth)acrylate having a repeating number of the propylene glycol unit of approximately 12, for example, FA-P270A gives more excellent recording properties in some cases and is thus more preferable.

Further, among the (meth)acrylate monomers (c-3a) listed in Group (I), the C5 to C18 alkyl (meth)acrylate and the alkylene glycol di(meth)acrylate having 7 to 18 carbon atoms are one of the preferable (meth)acrylate monomers. These impart excellent recording signal characteristics and durability in some cases. Among them, C10 to C15 alkyl (meth)acrylates are more preferable and particularly lauryl (meth)acrylate is preferable.

[0040]

In addition, by using a (meth)acrylate monomer (c-3a) in the above-described Group (I) in combination with the above (A) component, the elastic modulus of the cured product of the resin composition of the present invention can be a preferable elastic modulus (25°C) in the present invention, for example, in the range of 0.01 to 40 MPa or less, preferably less than 0.01 to 10 MPa and more preferably 0.01 to 9.5 MPa.

When the elastic modulus of a cured product layer of the resin composition of the present invention at 25°C is preferably adjusted to the above-described 0.01 to 40 MPa or less, an optical disc having said cured product layer on an interface layer laminated on an organic coloring matter recording layer is more excellent in recording properties.

These (meth)acrylate monomers (c-3a) in Group (I) can be used in the range of approximately 0 to 60%, preferably 10 to 60%, more preferably 20 to 60% and further preferably 30 to 60%, based on the total amount of the resin composition.

[0041]

Further, in the above-described (C-3) component, a (meth)acrylate monomer (c-3b) in the below-described Group (II) can be used according to necessity.

Group (II) :

Dicyclopentenylxyethyl (meth)acrylate (or dicyclopentadiene oxyethyl (meth)acrylate), 1,6-hexanediol di(meth)acrylate, dipropylene glycol di(meth)acrylate, or tripropylene glycol di(meth)acrylate.

By using a (meth)acrylate monomer (c-3b) in the above-described Group (II) together with the above (A) component, and according to necessity, either or both of the above (C-2) component or the above-described (c-3b) further, a cured product having less change in the elastic modulus of a cured product due to temperature change and a suitable degree of hardness can be obtained.

These (meth)acrylate monomers (c-3b) in Group (II) can be used in the range of approximately 0 to 60% based on the total amount of the resin composition, and preferably approximately 10 to 50%.

The more preferable component as the above-described (C) component can include C5 to C18 alkyl (meth)acrylate, polyethylene oxide 5 to 15 mol-modified bisphenol A-type di(meth)acrylate and dicyclopentadiene oxyethyl (meth)acrylate. A resin composition of the present invention in which at least one kind selected from the group consisting of these is contained and its content is 50 to 100% of the (C) component is more preferable.

[0042]

In the resin composition of the present invention, one or more kinds of these as the (C) component can be used as a mixture at any ratio. The content of the (C) component in the ultraviolet-curable resin composition is usually 90% or less, preferably 80% or less, more preferably 70% or less and further preferably 55% or less. The (C) component may be 0% but usually preferably contained. In the case of containing it, it may be more than 0%, preferably 4% or more, and also preferably 30 to 80% by weight or 40 to 70% by weight.

Meanwhile, in the case of using (C-1) and (C-2) in combination as the (C) component, each of (C-1) and/or (C-2) is usually 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 (C-3) is used in an amount of 20 to 80 parts by weight and preferably approximately 25 to 75 parts by weight based on 100 parts by weight of the (C) component.

One of the preferable resin compositions of the present invention can be an ultraviolet-curable resin composition for an optical disc, in which an (A) component and at least one kind selected from the group consisting of urethane (meth)acrylate (C-2), a (meth)acrylate monomer (c-3a) in the above Group (I) and a (meth)acrylate monomer (c-3b) in the above Group (II) as the above (meth)acrylate (C) is contained, the total amount of the (A) component, the (C-2) component, the (c-3a) component and the (c-3b) is 70 to 99%, more preferably 80 to 99% and further preferably 90 to 99% based on the total amount of the resin composition, the photopolymerization initiator (B) is 1 to 10%, and a (C) component other than the above-described ones or an additive is 0 to 20%.

[0043]

The content ratio of the (A) component, the (B) component and the (C) component in the resin composition of the present invention is:

usually,

the (A) component is 10 to 95% by weight (hereinafter, "%" means "% by weight"

unless otherwise specifically noted), the (B) component is 1 to 20% and the (C) component is 4% to 89%;

preferably,

the (A) component is 20 to 95%, the (B) component is 1 to 20% and the (C) component is 4% to 79%;

more preferably,

the (A) component is 30 to 95%, the (B) component is 1 to 10% and the (C) component is 4 to 69%;

further preferably,

the (A) component is 40 to 95%, the (B) component is 1 to 10% and the (C) component is 4 to 59%; and

most preferably,

the (A) component is 45 to 95%, the (B) component is 1 to 10% and the (C) component is 4 to 54%,

based on the total amount of the resin composition of the present invention.

[0044]

Some of the preferable embodiments of the resin composition of the present invention will be exemplified below.

(i) An embodiment in which three components of an (A) component, a (B) component and a (C) component are contained.

(ii) The embodiment according to the above-described (i), wherein the content ratio of the (A) component, the (B) component and the (C) component is any one of the above-described content ratios of the three components of the (A) component, the (B) component and the (C) component.

(iii) The embodiment according to the above-described (i) or (ii), wherein the (A) component is at least one kind selected from the group consisting of caprolactone-modified hydroxyethyl (meth)acrylate, caprolactone-modified hydroxybutyl (meth)acrylate, caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate, caprolactone-modified tris(acryloxyethyl)isocyanurate and

caprolactone-modified dipentaerythritol hexa(meth)acrylate.

(iv) The embodiment according to any one of the above-described (i) to (iii), wherein at least one kind selected from the group consisting of epoxy (meth)acrylate (C-1), urethane (meth)acrylate (C-2) and (meth)acrylate monomer (C-3) is contained as the (C) component.

[0045]

(v) The embodiment according to the above-described (iv), wherein urethane (meth)acrylate (C-2) is contained as the (C) component.

(vi) The embodiment according to any one of the above-described (i) to (iv), wherein the urethane (meth)acrylate (C-2) content is more than 0% and 15% or less based on the total amount of the resin composition of the present invention.

(vii) The embodiment according to the above-described (v) or (vi), wherein the urethane (meth)acrylate (C-2) is a urethane acrylate obtained by reaction of polyester polyol or polyether polyol, polyisocyanate and 2-hydroxyethyl acrylate.

(viii) The embodiment according to the above-described (iv) to (vi), wherein the urethane (meth)acrylate (C-2) is a urethane acrylate obtained using a poly C2-C6 alkylene glycol, polyisocyanate and a hydroxy (meth)acrylate compound.

(ix) The embodiment according to the above-described (vii) or (viii), wherein the polyisocyanate is isophorone diisocyanate.

[0046]

(x) The embodiment according to the above-described (viii) or (ix), wherein the hydroxy (meth)acrylate compound is hydroxy C2-C4 alkyl (meth)acrylate.

(xi) The embodiment according to any one of the above-described (i) to (x), wherein a (meth)acrylate monomer (C-3) is contained as the (C) component.

(xii) The embodiment according to the above-described (xi), wherein at least one kind selected from the group consisting of (meth)acrylate monomers (c-3a) in the above Group (I) and (meth)acrylate monomers (c-3b) in the above Group (II) is contained as the above-described (meth)acrylate monomer (C-3).

(xiii) The embodiment according to the above-described (xii), wherein at least one

kind from the above-described (meth)acrylate monomers (c-3a) is contained.

(xiv) The embodiment according to the above-described (xii) or (xiii), wherein a C5 to C18 alkyl (meth)acrylate is contained as the above (c-3a).

(xv) The embodiment according to the above-described (xiv), wherein a C10 to C15 alkyl (meth)acrylate is contained as the above (c-3a).

(xvi) The embodiment according to any one of the above-described (xii) to (xv), wherein propylene oxide-modified mono- or di(meth)acrylate is contained as the above (c-3a).

(xvii) The embodiment according to the above-described the above-described (xii) to (xvi), wherein polyethylene oxide 5 to 15 mol-modified bisphenol A-type di(meth)acrylate is contained as the above (c-3a).

[0047]

(xviii) The embodiment according to any one of the above-described (xii) to (xvii), at least one kind from (meth)acrylate monomers (c-3b) in the above Group (II) is contained.

(xix) The embodiment according to the above-described (xviii), wherein dicyclopentadiene oxyethyl (meth)acrylate is contained as the above-described (c-3b).

(xx) The embodiment according to any one of the above-described (xii) to (xix), wherein the content of the at least one kind selected from the group consisting of the above (c-3a) and (c-3b) is 10 to 60% based on the total amount of the resin composition of the present invention.

(xxi) The embodiment according to the above-described (xx), wherein the content of the at least one kind selected from the group consisting of the above (c-3a) is 20 to 50%.

(xxii) The embodiment according to the above-described (xx), wherein the content of the at least one kind selected from the group consisting of the above (c-3a) is 30 to 50%.

(xxiii) The embodiment according to any one of the above-described (xii) and (xx) to

(xxii), wherein at least one kind selected from the group consisting of C5 to C18 alkyl (meth)acrylate, polyethylene oxide 5 to 15 mol-modified bisphenol A-type di(meth)acrylate, dicyclopentadiene oxyethyl (meth)acrylate and polypropylene glycol di(meth)acrylate is contained as the above-described (meth)acrylate monomer (C-3), and the content is 50% to 100% based on the total amount of the (C) component.

[0048]

(xxiv) The embodiment according to the above-described (xxiii), wherein a C5 to C18 alkyl (meth)acrylate is contained as the (C) component.

(xxv) The embodiment according to (xxiv), wherein the C5 to C18 alkyl (meth)acrylate is lauryl (meth)acrylate.

(xxvi) The embodiment according to any one of the above-described (i) to (xxv), wherein the later-described hindered amine is contained in an amount of 0.01 to 3% based on the total amount of the resin composition of the present invention.

(xxvii) The embodiment according to any one of the above-described (i) to (xxvi), wherein the elastic modulus at 25°C of the cured product of the resin composition of the present invention is 0.01 to 40 MPa.

(xxviii) The embodiment according to the above-described (xxvii), wherein the elastic modulus at 25°C of the cured product of the resin composition of the present invention is 0.01 to 9.5 MPa.

[0049]

To the ultraviolet-curable resin composition for an optical disc of the present invention, an additive such as a rust preventive agent, 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, hindered amine compound, and the like) and a filler may be added according to necessity. Specific examples of the hindered amine compound include, 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. The mixing amount of these additives based on

the total amount of the resin composition of the present invention is within the range of approximately 0 to 10%.

The hindered amine compound is one of the preferable additives and can be added in the range of 0.001 to 10% and preferably in the range of 0.01 to 3% based on the total amount of the resin composition of the present invention.

[0050]

The ultraviolet-curable resin composition for an optical disc of the present invention can be obtained by mixing and dissolving the components described above at ordinary temperature to 80°C, and according to necessity, foreign substances may be removed out by an operation such as filtration. For the resin composition for adhesion of the present invention, it is preferred to appropriately adjust the mixing ratio of the components so that the viscosity at 25°C is in the range of 30 to 2000 MPa·s from a viewpoint of coating properties.

[0051]

The ultraviolet-curable resin composition for an optical disc of the present invention can be suitably used as a coating agent for a light transmitting layer on the laser incidence side in a Blu-ray Disc and the like. Specifically, the composition is coated on an optical disc substrate 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 coated resin is 1 to 100 µm. After coating, irradiation with an ultraviolet to near ultraviolet ray (wavelength of around 200 to 400 nm) is carried out from one side or both sides for curing. The irradiation amount 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 irradiating with an ultraviolet to near ultraviolet ray. For example, it includes a low pressure, high pressure or ultrahigh pressure mercury lamp, a metal halide lamp, a (pulse) xenon lamp, an electrodeless lamp or the like.

[0052]

The ultraviolet-curable resin composition of the present invention is, in the case where a light transmitting layer comprises a first resin layer formed on a recording layer or an interface layer and a second resin layer formed on the surface opposite from the recording layer or interface layer side in relation of the first resin layer, 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 .

On the other hand, 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 .

[0053]

In the case where the light transmitting layer (protective layer) is composed of two layers, the composition is coated on the optical disc substrate by an arbitrary method, for example, a spin coating method, a 2P method, a roll coating method, a screen printing method or the like as the light transmitting layer (protective layer) forming method so that the film thickness of the resin coated as a first resin layer is specifically 1 to 30 μm . After coating, irradiation with an ultraviolet to near ultraviolet ray (wavelength around 200 to 400 nm) is carried out from one side or both sides for curing. The irradiation amount is preferably 50 to 1500 mJ/cm^2 and particularly preferably, approximately 100 to 1000 mJ/cm^2 . After curing, the composition is coated on the optical disc substrate 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 70 to 100 μm . After coating, irradiation an ultraviolet to near ultraviolet ray (wavelength around 200 to 400 nm) is carried out from one side or both sides for curing. The irradiation amount is preferably about 50 to 1500 mJ/cm^2 and particularly preferably, approximately 100 to 1000 mJ/cm^2 . Further, for curing by irradiation with an ultraviolet to near ultraviolet ray, the light source can be any light source as long as it is a lamp irradiating with an ultraviolet to near ultraviolet ray. For example, it can include a low pressure, high pressure or ultrahigh pressure mercury lamp, a metal halide lamp, a (pulse) xenon

lamp, an electrodeless lamp or the like.

[0054]

The optical disc of the present invention obtained as described above is an optical disc having, at least, a plastic supporting substrate such as carbonate which has a guide groove, a reflecting layer formed on said guide groove, an organic coloring matter (usually azo coloring matter or the like) recording layer which is 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 optical disc of the present invention may further has a cured product layer of another resin composition on the cured product layer of the resin composition of the present invention. In this 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.

In the optical disc of the present invention, it is necessary that a cured product layer of the resin composition of the present invention is formed directly on an interface layer formed on a recording layer containing an organic coloring matter (usually azo coloring matter or the like), whereby the effects of the present invention are achieved.

The interface layer is, as known to 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.

Examples

[0055]

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

[0056]

By uniformly mixing the components at the ratio (part(s) by weight) shown

in Table 1, ultraviolet-curable resin compositions of Examples 1 to 5 were prepared.

[0057]

Table 1. Resin composition and evaluation result

	Example 1	Example 2	Example 3	Example 4	Example 5
Component (A)					
SR-495	85				55
HX-620		60	60		
DPCA-120				50	
Component (B)					
IRGACURE -184	4	4	4	4	4
Component (C)					
UA-1	10				10
BPE-10		15	15		
FA-512A		20			
Lauryl acrylate			20	45	
FA-P270A					30
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	6.5	6.6	6.3	6.2	6.6
Judgment	O	O	O	O	O
Jitter value (%) after durabi lity test	9.0	8.9	8.0	8.5	9.2
Judgment	O	O	O	O	O
Elastic modulus (MPa) 25°C/1H z	0.4	20	16	36	7.0

[0058]

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

SR-495: Caprolactone-modified (2 mol-modified)hydroxyethyl acrylate, manufactured by Sartomer Company,Inc.

HX-620: Caprolactone-modified (4 mol-modified) hydroxypivalic acid neopentyl glycol diacrylate, manufactured by Nippon Kayaku Co., Ltd.

DPCA-120: Caprolactone-modified (6 mol-modified) dipentaerythritol hexaacrylate, manufactured by Nippon Kayaku Co., Ltd.

UA-1: Urethane acrylate obtained by reaction of 3 components of polytetramethylene glycol (molecular weight 850), isophorone diisocyanate and 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.)

FA-512A: Dicyclopentadiene oxyethyl acrylate (manufactured by Hitachi Chemical Co., Ltd.)

FA-P270A: Polypropylene glycol diacrylate (trade name: FANCRYL^{RTM} FA-P270A, manufactured by Hitachi Chemical Co., Ltd.)

IRGACURE-184: 1-Hydroxycyclohexylphenyl ketone (manufactured by Ciba Specialty Chemicals)

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

PMP: 4-Mercapto phenol

[0059]

Using each of the obtained ultraviolet-curable resin compositions of the present invention, a Blu-ray Disc having a coloring matter recording layer was manufactured and evaluated for properties.

[0060]

Manufacture of Blu-ray Disc having an organic coloring matter recording 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 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 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 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 1000 rpm to 1500 rpm for 4 seconds to 7 seconds so that the thickness of each coated film was 25 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/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 thickness of the coated film after curing 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/cm² for 3 seconds to completely cure the BRD-864, and a Blu-ray Disc of the present invention was thus manufactured.

[0061]

(i) Recording signal characteristics before and after durability test of Blu-ray Disc

The optical discs of the present invention were 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, and T continuous recording (1 T length = 0.08 μ m), 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.

[0062]

(ii) Measurement of elastic modulus of the resin cured product layers of the present invention

The elastic modulus was measured according to a dynamic viscoelasticity measuring method based on JIS K 7244-5. That is, a coating film was formed with each resin composition of the present invention so that the thickness after curing was 1 mm and cured using a Fusion lamp D bulb at an integrated light amount of 1 J/cm², and then a sample piece having a size of a length of 5 cm, a width of 1 cm and a thickness of 1 mm was made and measured by a viscoelasticity measuring device: DMS6100, manufactured by SII Nano Technology Inc. The measurement was carried out in bending mode under the conditions of an amplitude loading of 10 mN, a frequency of 1 Hz and a temperature rising rate of 2°C/minute in the range of -50°C to 200°C.

(iii) Light transmittance of the resin cured product layer of the present invention at 405 nm:

A 100 μm cured film was made, and using a spectrophotometer (U-3310, manufactured by Hitachi High-Technologies Corporation), the absorbance value of said film at 405 nm was measured to determine its light transmittance. As the result, any of the cured products of the resin compositions of Examples 1 to 5 has a light transmittance of 85% or more.

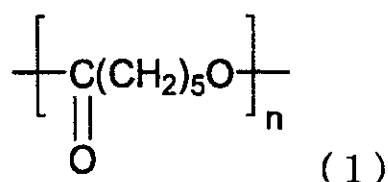
[0063]

Judging from the results in Table 1, the resin compositions of the present invention of Examples 1 to 5 containing a (meth)acrylate having a structure shown by the formula (1) had good recording signal characteristics before and after durability test.

Claims

1. An optical disc having an interface layer on an organic coloring matter recording layer and having a cured product layer of an ultraviolet-curable resin composition (hereinafter, referred to simply as resin composition) containing:

(A) a (meth)acrylate (however, except for urethane (meth)acrylate) having a structure shown by the following the formula (1):



(wherein, n denotes an integer number of 1 to 10)

and

(B) a photopolymerization initiator,
on the interface layer.

2. The optical disc according to Claim 1, wherein the (meth)acrylate (A) having a structure shown by the formula (1) is at least one kind selected from the group consisting of caprolactone-modified hydroxyethyl (meth)acrylate, caprolactone-modified hydroxybutyl (meth)acrylate, caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate, caprolactone-modified tris(acryloxyethyl)isocyanurate and caprolactone-modified dipentaerythritol hexa(meth)acrylate.

3. The optical disc according to Claim 1, wherein the above resin composition is an ultraviolet-curable resin composition further containing a (meth)acrylate (C) other than (A).

4. The optical disc according to Claim 1, wherein the (meth)acrylate (A) having a

structure shown by the formula (1) is contained in an amount of 20 to 95% by weight based on the above the whole resin composition.

5. The optical disc according to Claim 3, wherein the above (meth)acrylate (C) is at least one kind selected from the group consisting of: urethane acrylate as a reaction product of polyester polyol or polyether polyol with polyisocyanate and 2-hydroxyethyl acrylate; and polyethylene oxide-modified bisphenol A-type diacrylate.

6. The optical disc according to Claim 3, wherein at least one kind selected from the group consisting of a (meth)acrylate monomer (c-3a) in Group (I) described below and a (meth)acrylate monomer (c-3b) in Group (II) described below is contained as the above (meth)acrylate (C):

Group (I) (c-3a):

(i) C5 to C18 alkyl (meth)acrylate, or alkylene glycol di(meth)acrylate having 7 to 18 carbon atoms;

(ii) propylene oxide-modified mono- or di(meth)acrylate;

(iii) polyethylene oxide-modified bisphenol A-type di(meth)acrylate;

(iv) polyethylene oxide-modified phenol acrylate; or

(v) (meth)acrylate having a polytetramethylene glycol structure,

and

Group (II) (c-3b):

dicyclopentenyl oxyethyl (meth)acrylate (or dicyclopentadiene oxyethyl (meth)acrylate), 1,6-hexanediol di(meth)acrylate, dipropylene glycol di(meth)acrylate or tripropylene glycol di(meth)acrylate.

7. The optical disc according to Claim 6, a (meth)acrylate monomer (c-3a) in the above-described Group (I) is contained as the above (meth)acrylate (C).

8. The optical disc according to Claim 7, wherein a C5 to C18 alkyl (meth)acrylate is

contained as the (meth)acrylate monomer (c-3a) in the above-described Group (I).

9. The optical disc according to Claim 6, wherein a (meth)acrylate monomer (c-3b) in the above-described Group (II) is contained as the above (meth)acrylate (C).

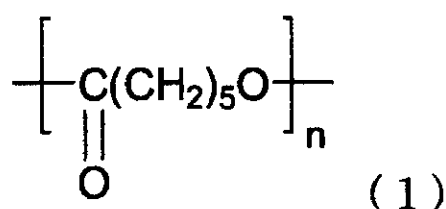
10. The optical disc according to Claim 3, wherein a urethane (meth)acrylate (C-2) is contained as the above (meth)acrylate (C).

11. The optical disc according to Claim 10, wherein the above urethane (meth)acrylate (C-2) is a urethane (meth)acrylate obtained by reaction of a poly C2 to C6 alkylene glycol, isophorone diisocyanate and a hydroxy C2 to C4 (meth)acrylate.

12. The optical disc according to Claim 1, wherein the above resin composition is a resin composition further containing a hindered amine compound (D).

13. A method for manufacturing an optical disc, which comprises a process of coating an ultraviolet-curable resin composition containing at least

(A) a (meth)acrylate having a structure shown by the following formula (1):



(wherein, n denotes an integer number of 1 to 10)

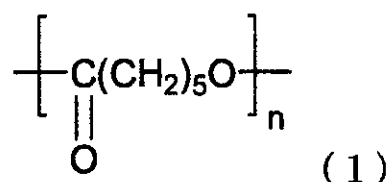
and

(B) a photopolymerization initiator,

on an interface layer which an optical disc substrate has on an organic coloring matter recording layer, and subsequently said coated film is irradiated with an active energy ray to form a cured product layer.

14. The method for manufacturing an optical disc according to Claim 13, wherein the ultraviolet-curable resin composition is an ultraviolet-curable resin composition further containing a (meth)acrylate (C) other than (A).

15. An ultraviolet-curable resin composition for an optical disc containing (A) a (meth)acrylate (however, except for urethane (meth)acrylate) having a structure shown by the following formula (1):



(wherein, n denotes an integer number of 1 to 10)

and

(B) a photopolymerization initiator.

16. The ultraviolet-curable resin composition for the optical disc according to Claim 15, wherein the (meth)acrylate (A) having a structure shown by the formula (1) is at least one kind selected from the group consisting of caprolactone-modified hydroxyethyl (meth)acrylate, caprolactone-modified hydroxybutyl (meth)acrylate, caprolactone-modified hydroxypivalic acid neopentyl glycol di(meth)acrylate, caprolactone-modified tris(acryloxyethyl)isocyanurate and caprolactone-modified dipentaerythritol hexa(meth)acrylate.

17. The ultraviolet-curable resin composition for the optical disc according to Claim 15, which further contains a (meth)acrylate (C) other than the above-described (A).

18. The ultraviolet-curable resin composition for an optical disc according to Claim 15, wherein the (meth)acrylate (A) having a structure shown by the formula (1) is contained in an amount of 20 to 95% by weight based on the above whole resin

composition.

19. The ultraviolet-curable resin composition for an optical disc according to Claim 15, wherein the above (meth)acrylate (C) is at least one kind selected from the group consisting of: urethane acrylate as a reaction product of polyester polyol or polyether polyol with polyisocyanate and 2-hydroxyethyl acrylate; and polyethylene oxide-modified bisphenol A-type diacrylate.

20. The ultraviolet-curable resin composition for an optical disc according to Claim 15, wherein at least one kind selected from the group consisting of a (meth)acrylate monomer (c-3a) in Group (I) described below and a (meth)acrylate monomer (c-3b) in Group (II) described below is contained as the above (meth)acrylate (C),

Group (I) (c-3a):

- (i) C5 to C18 alkyl (meth)acrylate, or alkylene glycol di(meth)acrylate having 7 to 18 carbon atoms;
- (ii) propylene oxide-modified mono- or di(meth)acrylate;
- (iii) polyethylene oxide-modified bisphenol A-type di(meth)acrylate;
- (iv) polyethylene oxide-modified phenol acrylate;
- (v) (meth)acrylate having a polytetramethylene glycol structure;

Group (II) (c-3b):

dicyclopentenylxyethyl (meth)acrylate, 1,6-hexanediol di(meth)acrylate, dipropylene glycol di(meth)acrylate or tripropylene glycol di(meth)acrylate.

21. The ultraviolet-curable resin composition for an optical disc according to Claim 20, wherein a (meth)acrylate monomer (c-3a) in the above-described Group (I) is contained as the above (meth)acrylate (C).

22. The ultraviolet-curable resin composition for an optical disc according to Claim 21, wherein a C5 to C18 alkyl (meth)acrylate is contained as the (meth)acrylate monomer

(c-3a) in the above-described Group (I).

23. The ultraviolet-curable resin composition for the optical disc according to Claim 21, wherein the content of the (meth)acrylate monomer (c-3a) in the above-described Group (I) is 20 to 60% by weight based on the total amount of the resin composition.

24. The ultraviolet-curable resin composition for an optical disc according to Claim 20, wherein a (meth)acrylate monomer (c-3b) in the above-described Group (II) is contained as the above (meth)acrylate (C).

25. The ultraviolet-curable resin composition for an optical disc according to Claim 17, wherein a urethane (meth)acrylate (C-2) is contained as the above (meth)acrylate (C).

26. The ultraviolet-curable resin composition for the optical disc according to Claim 25, wherein said urethane (meth)acrylate (C-2) is a urethane (meth)acrylate obtained by reaction of a poly C2 to C6 alkylene glycol, isophorone diisocyanate and a hydroxy C2 to C4 (meth)acrylate.

27. The ultraviolet-curable resin composition for an optical disc according to Claim 17, wherein at least one kind selected from the group consisting of a C5 to C18 alkyl (meth)acrylate, polyethylene oxide 5 to 15 mol-modified bisphenol A-type di(meth)acrylate, dicyclopentadiene oxyethyl (meth)acrylate and polypropylene glycol di(meth)acrylate is contained as the (C) component and the content is 50% to 100% based on the total amount of the (C) component.

28. The ultraviolet-curable resin composition for an optical disc according to Claim 17, wherein the (A) component and at least one kind selected from the group consisting of urethane (meth)acrylate (C-2), a (meth)acrylate monomer (c-3a) in the above

Group (I) and a (meth)acrylate monomer (c-3b) in the above Group (II) as the above (meth)acrylate (C) are contained and the total amount of the (A) component, the (C-2) component, the (c-3a) component and the (c-3b) component is 70 to 99% by weight based on the total amount of the resin composition.

29. The ultraviolet-curable resin composition for the optical disc according to Claim 28, wherein at least one kind selected from the group consisting of a (meth)acrylate monomer (c-3a) in the above Group (I) and a (meth)acrylate monomer (c-3b) in the above Group (II) is contained.

30. The ultraviolet-curable resin composition for the optical disc according to Claim 28, wherein (i) the (A) component is caprolactone-modified hydroxyethyl (meth)acrylate or (ii) a (meth)acrylate monomer (c-3a) in the above Group (I) is contained, when the urethane (meth)acrylate (C-2) is contained.

31. The ultraviolet-curable resin composition for an optical disc according to Claim 15, wherein a hindered amine compound (D) is further contained.

32. The ultraviolet-curable resin composition for an optical disc according to Claim 17, wherein the elastic modulus at 25°C of a cured product upon curing is 0.01 to 9.5 MPa.