favorable pattern shape due to combined use of radical polymerizable compounds having different numbers of ethylenic unsaturated bond groups and therefore none of them has sufficient properties for use as a material that forms a pixel-separating layer in an organic EL display.

[0011] Therefore, an object of the present disclosure is to provide a negative-type photosensitive resin composition that is highly sensitive and capable of formation of a low-taper pattern shape and that is capable of providing a cured film that is excellent in heat resistance.

Means for Solving the Problems

[0012] The negative-type photosensitive resin composition of the present disclosure is a negative-type photosensitive resin composition that contains an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator, characterized in that the (A) alkali-soluble resin contains one or more species of resins selected from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, a (A-4) polybenzoxazole precursor, a (A-5) polysiloxane, and a (A-6) cardo based resin and that the (B) radical polymerizable compound contains a compound having five ethylenic unsaturated bond groups in a (B-1) molecule, in an amount within a range of 51 to 99 mass%.

[0012a] In an aspect, there is provided a negative-type photosensitive resin composition comprising an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator,

the negative-type photosensitive resin composition being characterized in that the (A) alkali-soluble resin contains one or more species of resins selected from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, a (A-4) polybenzoxazole precursor, and a (A-6) cardo based resin, wherein a content ratio of a total of one or more species of resins selected from the (A-1) polyimide, (A-2) polybenzoxazole, (A-3) polyimide precursor, (A-4) polybenzoxazole precursor, and (A-6) cardo based resin in a total of 100 mass% of the (A) alkali-soluble resin is within a range of 50 to 100 mass%; and

that a content ratio of a compound having five ethylenic unsaturated bond groups in a (B-1) molecule in a total of the (B) radical polymerizable compound is within a range of 51 to 99 mass%.

[0012b] In another aspect, there is provided a negative-type photosensitive resin composition comprising an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator,

the negative-type photosensitive resin composition being characterized in that the (A) alkali-soluble resin contains one or more species of resins selected from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, a (A-4) polybenzoxazole precursor, a (A-5) polysiloxane, and a (A-6) cardo based resin, and that a content ratio of the compound having five ethylenic unsaturated bond groups in a (B-1) molecule in a total of the (B) radical polymerizable compound, is within a range of 71 to 99 mass%.

[0012c] A negative-type photosensitive resin composition comprising an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator,

the negative-type photosensitive resin composition being characterized in that the (A) alkali-soluble resin contains one or more species of resins selected from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, and a (A-4) polybenzoxazole precursor, and

that a content ratio of a compound having five ethylenic unsaturated bond groups in a (B-1) molecule in a total of the (B) radical polymerizable compound is within a range of 51 to 99 mass%.

[0012d] A negative-type photosensitive resin composition comprising an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator,

the negative-type photosensitive resin composition being characterized in that the (A) alkali-soluble resin contains one or more species of resins selected

from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, and a (A-4) polybenzoxazole precursor, and

that the (A-1) polyimide, the (A-2) polybenzoxazole, the (A-3) polyimide precursor, and the (A-4) polybenzoxazole precursor in the (A) alkali-soluble resin contain a structural unit having a fluorine atom, in an amount of 30 to 100 mol% of entire structural units, and

that a content ratio of a compound having five ethylenic unsaturated bond groups in a (B-1) molecule in a total of the (B) radical polymerizable compound is within a range of 51 to 99 mass%.

[0012e] In another aspect, there is provided a cured film obtained by curing the negative-type photosensitive resin composition as defined above.

[0012f] In another aspect, there is provided a display device comprising the cured film as defined above.

[0012g] In another aspect, there is provided a production method for a display device, comprising:

(1) a step of forming a film of the negative-type photosensitive resin composition as defined above on a substrate;

(2) a step of irradiating the negative-type photosensitive resin composition formed as the film with a chemical active ray via a photomask and then forming a pattern by using an alkali solution; and

(3) a step of forming a cured pattern by heating the pattern.

Advantageous Effects

[0013] According to the negative-type photosensitive resin composition of the present disclosure, it is possible to obtain a cured film that is highly sensitive, capable of formation of a low-taper pattern shape, and excellent in heat

resistance.

Brief Description of the Drawings

[0014] [Fig. 1] Fig. 1 is a process diagram illustrating an example of a production process for an organic EL display that uses a cured film of the negative-type photosensitive resin composition of the present invention.

[Fig. 2] Fig. 2 is a process diagram illustrating an example of a production process for a liquid crystal display that uses a cured film of the negative-type

Claims

[Claim 1] A negative-type photosensitive resin composition comprising an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator,

the negative-type photosensitive resin composition being characterized in that the (A) alkali-soluble resin contains one or more species of resins selected from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, a (A-4) polybenzoxazole precursor, and a (A-6) cardo based resin, wherein a content ratio of a total of one or more species of resins selected from the (A-1) polyimide, (A-2) polybenzoxazole, (A-3) polyimide precursor, (A-4) polybenzoxazole precursor, and (A-6) cardo based resin in a total of 100 mass% of the (A) alkali-soluble resin is within a range of 50 to 100 mass%; and

that a content ratio of a compound having five ethylenic unsaturated bond groups in a (B-1) molecule in a total of the (B) radical polymerizable compound is within a range of 51 to 99 mass%.

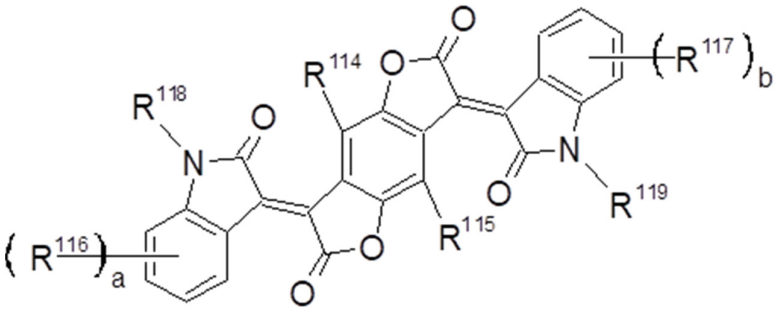
[Claim 2] The negative-type photosensitive resin composition according to Claim 1, further comprising a (D) coloring agent, wherein the (D) coloring agent contains a (Da) black coloring agent.

[Claim 3] The negative-type photosensitive resin composition according to Claim 2, wherein the (Da) black coloring agent is constituted by one or more species selected from a (D1a-1) black organic pigment, a (D1a-2) black inorganic pigment, and a (D1a-3) mixture of two or more coloring pigments.

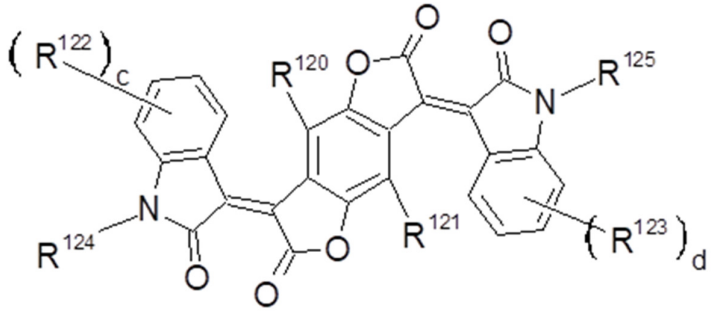
[Claim 4] The negative-type photosensitive resin composition according to Claim 3, wherein the (Da) black coloring agent contains the (D1a-1) black organic pigment, wherein the (D1a-1) black organic pigment is a (D1a-1a) benzofuranone based black pigment and/or a (D1a-1b) perylene based black pigment,
wherein the (D1a-1a) benzofuranone based black pigment is a benzofuranone compound represented by any one of general formulas (38) to (43), its

geometrical isomer, its salt, or a salt of its geometrical isomer, and

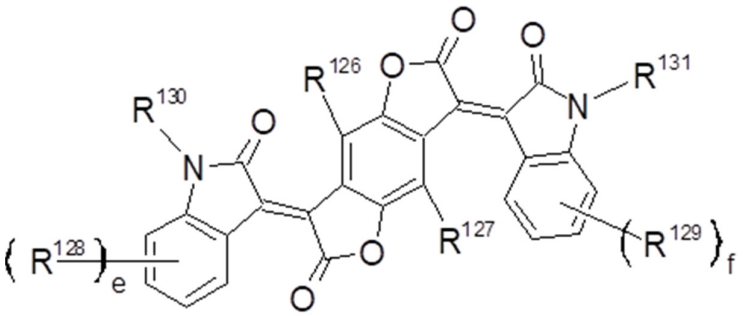
wherein the (D1a-1b) perylene based black pigment is a perylene compound represented by any one of general formulas (44) to (46), its geometrical isomer, its salt, or a salt of its geometrical isomer.



(38)



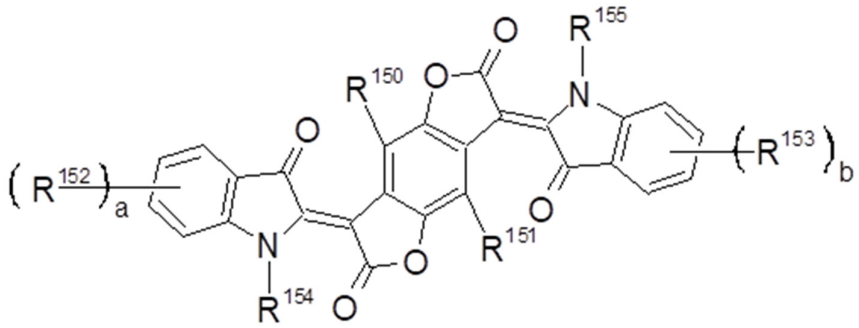
(39)



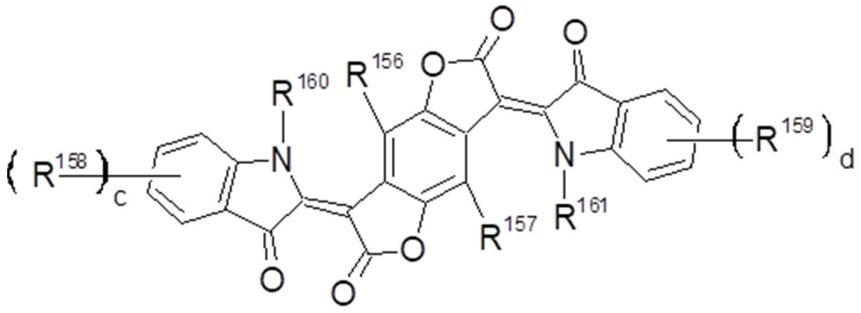
(40)

wherein in general formulas (38) to (40), R^{114}, R^{115}, R^{120}, R^{121}, R^{126} and R^{127} each independently represent hydrogen, a halogen atom, an alkyl group having a carbon number of 1 to 10, or an alkyl group having a carbon number of 1 to 10 and having 1 to 20 fluorine atoms; R^{116}, R^{117}, R^{122}, R^{123}, R^{128} and R^{129} each independently represent hydrogen, a halogen atom, R^{251}, COOH, $COOR^{251}$, COO^{-}, $CONH_2$, $CONHR^{251}$, $CONR^{251}R^{252}$, CN, OH, OR^{251}, $OCOR^{251}$, $OCONH_2$,

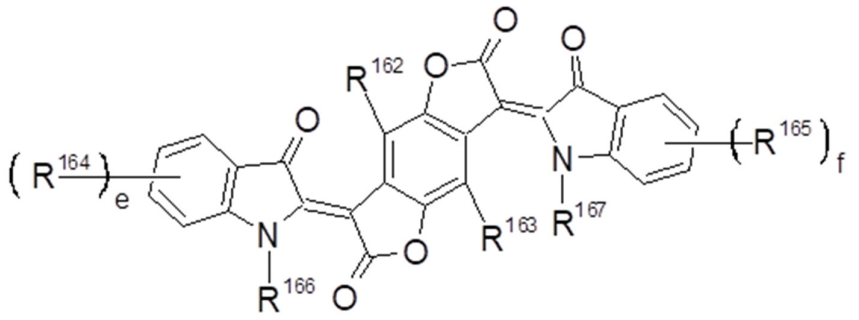
$OCONHR^{251}$, $OCONR^{251}R^{252}$, NO_2, NH_2, NHR^{251}, $NR^{251}R^{252}$, $NHCOR^{251}$, $NR^{251}COR^{252}$, $N{=}CH_2$, $N{=}CHR^{251}$, $N{=}CR^{251}R^{252}$, SH, SR^{251}, SOR^{251}, SO_2R^{251}, SO_3R^{251}, SO_3H, SO_3^-, SO_2NH_2, SO_2NHR^{251}, or $SO_2NR^{251}R^{252}$, and R^{251} and R^{252} each independently represent an alkyl group having a carbon number of 1 to 10, a cycloalkyl group having a carbon number of 4 to 10, an alkenyl group having a carbon number of 2 to 10, a cycloalkenyl group having a carbon number of 4 to 10, or an alkynyl group having a carbon number of 2 to 10; A plurality of R^{116}, R^{117}, R^{122}, R^{123}, R^{128} or R^{129} may form a ring by direct bonds or by an oxygen atom bridge, a sulfur atom bridge, an NH bridge, or NR^{251} bridge; R^{118}, R^{119}, R^{124}, R^{125}, R^{130} and R^{131} each independently represent hydrogen, an alkyl group having a carbon number of 1 to 10, or an aryl group having a carbon number of 6 to 15; a, b, c, d, e and f each independently represent an integer of 0 to 4.



(41)



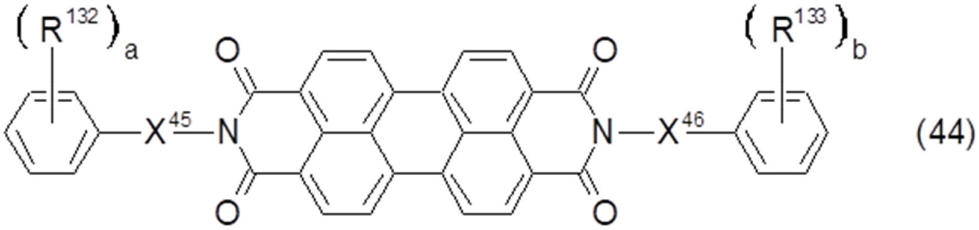
(42)



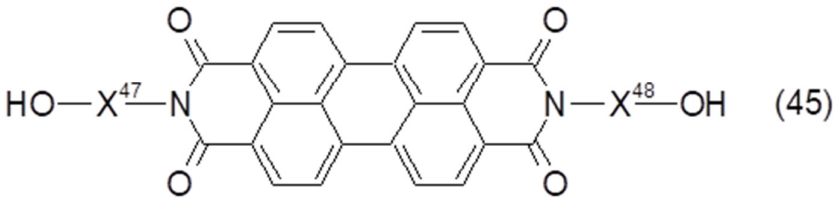
(43)

wherein in general formulas (41) to (43), R^{150}, R^{151}, R^{156}, R^{157}, R^{162} and R^{163} each independently represent hydrogen, a halogen atom, an alkyl group having a carbon number of 1 to 10, or an alkyl group having a carbon number of 1 to 10 and having 1 to 20 fluorine atoms; R^{152}, R^{153}, R^{158}, R^{159}, R^{164} and R^{165} each independently represent hydrogen, halogen atom, R^{271}, COOH, $COOR^{271}$, COO^-, $CONH_2$, $CONHR^{271}$, $CONR^{271}R^{272}$, CN, OH, OR^{271}, $OCOR^{271}$, $OCONH_2$, $OCONHR^{271}$, $OCONR^{271}R^{272}$, NO_2, NH_2, NHR^{271}, $NR^{271}R^{272}$, $NHCOR^{271}$, $NR^{271}COR^{272}$, $N=CH_2$, $N=CHR^{271}$, $N=CR^{271}R^{272}$, SH, SR^{271}, SOR^{271}, SO_2R^{271}, SO_3R^{271}, SO_3H, SO_3^-, SO_2NH_2, SO_2NHR^{271}, or $SO_2NR^{271}R^{272}$, and R^{271} and R^{272} each independently represent an alkyl group having a carbon number of 1 to 10, a cycloalkyl group having a carbon number of 4 to 10, an alkenyl group having a

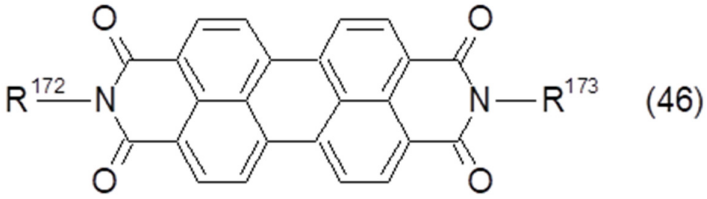
carbon number of 2 to 10, a cycloalkenyl group having a carbon number of 4 to 10, or an alkynyl group having a carbon number of 2 to 10; a plurality of R^{152}, R^{153}, R^{158}, R^{159}, R^{164} and R^{165} may form a ring by direct bonds or by an oxygen atom bridge, a sulfur atom bridge, an NH bridge, or an NR^{271} bridge; R^{154}, R^{155}, R^{160}, R^{161}, R^{166} and R^{167} each independently represent hydrogen, an alkyl group having a carbon number of 1 to 10, or an aryl group having a carbon number of 6 to 15; a, b, c, d, e and f each independently represent an integer or 0 to 4.



(44)



(45)



(46)

wherein in general formulas (44) to (46), X^{45}, X^{46}, X^{47} and X^{48} each independently represent an alkylene chain having a carbon number of 1 to 10; R^{132} and R^{133} each independently represent hydrogen, a hydroxy group, an alkoxy group having a carbon number of 1 to 6, and an acyl group having a carbon number of 2 to 6; R^{172} and R^{173} each independently represent hydrogen or an alkyl group having a carbon number of 1 to 10; a and b each independently represent an integer of 0 to 5.

[Claim 5] The negative-type photosensitive resin composition according to

Claim 4, wherein the (D1a-1) black organic pigment is a (D1a-1a) benzofuranone based black pigment.

[Claim 6] The negative-type photosensitive resin composition according to Claim 5, wherein further contains an (E) dispersant and a solvent,

wherein the (E) dispersant contains any one of a dispersant having an amine value alone, a dispersant having an amine value and an acid value, a dispersant having a structure in which an amino group and/or an acidic group form a salt together with an acid and/or a base,

wherein the solvent contains a solvent having a carbonyl group or an ester bond,

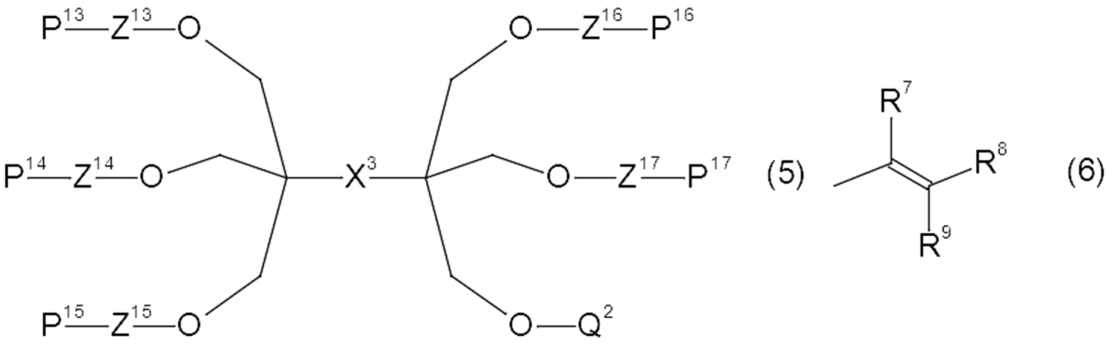
wherein the solvent having a carbonyl group or an ester bond contains a solvent having an acetate bond.

[Claim 7] The negative-type photosensitive resin composition according to any one of Claims 1 to 6, wherein a content ratio of a compound having 6 to 10 ethylenic unsaturated bond groups in a (B-2) molecule in a total of the (B) radical polymerizable compound is within a range of 1 to 49 mass%.

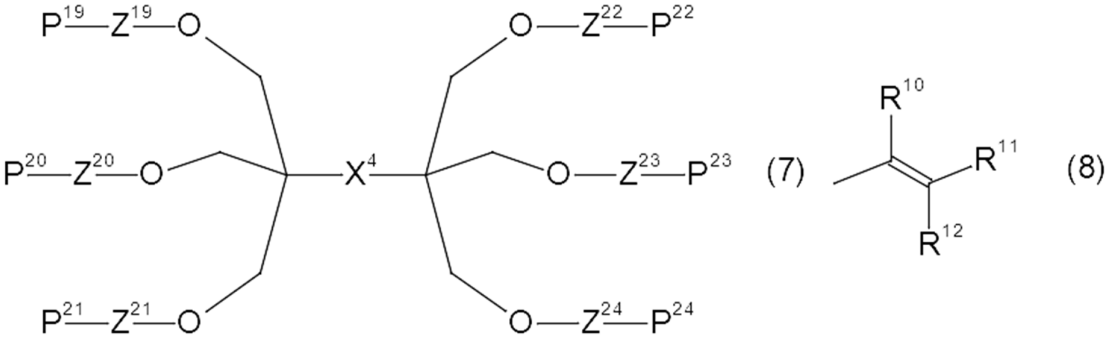
[Claim 8] The negative-type photosensitive resin composition according to Claim 7,

wherein the compound having five ethylenic unsaturated bond groups in the (B-1) molecule is a compound represented by general formula (5) mentioned below, and

wherein the compound having 6 to 10 ethylenic unsaturated bond groups in the (B-2) molecule is a compound represented by general formula (7) mentioned below.



wherein in general formula (5), X^3 represents a bivalent organic group; Z^{13} to Z^{17} each independently represent a direct bond, a carbonyl group, an alkylene group having a carbon number of 1 to 10, or an arylene group having a carbon number of 6 to 15; P^{13} to P^{17} each independently represent a substituent represented by general formula (6) mentioned below; Q^2 represents hydrogen, an alkyl group having a carbon number of 1 to 10, or an aryl group having a carbon number of 6 to 15; and in general formula (6), R^7 to R^9 each independently represent hydrogen, an alkyl group having a carbon number of 1 to 10, or an aryl group having a carbon number of 6 to 15.



wherein in general formula (7), X^4 represents a bivalent organic group; Z^{19} to Z^{24} each independently represent a direct bond, a carbonyl group, an alkylene group having a carbon number of 1 to 10, or an arylene group having a carbon number of 6 to 15; P^{19} to P^{24} each independently represent a substituent represented by general formula (8); and in general formula (8), R^{10} to R^{12} each independently represent hydrogen, an alkyl group having a carbon number of 1 to 10, or an aryl group having a carbon number of 6 to 15.

[Claim 9] The negative-type photosensitive resin composition according to any

one of Claims 1 to 8, wherein a content ratio of a compound having 2 to 4 ethylenic unsaturated bond groups in a (B-3) molecule in a total of the (B) radical polymerizable compound is within a range of 1 to 49 mass%.

[Claim 10] A negative-type photosensitive resin composition comprising an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator,

the negative-type photosensitive resin composition being characterized in that the (A) alkali-soluble resin contains one or more species of resins selected from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, a (A-4) polybenzoxazole precursor, a (A-5) polysiloxane, and a (A-6) cardo based resin, and that a content ratio of the compound having five ethylenic unsaturated bond groups in a (B-1) molecule in a total of the (B) radical polymerizable compound, is within a range of 71 to 99 mass%.

[Claim 11] The negative-type photosensitive resin composition according to Claim 10, wherein a content ratio of a total of one or more species of resins selected from the (A-1) polyimide, (A-2) polybenzoxazole, (A-3) polyimide precursor, (A-4) polybenzoxazole precursor, (A-5) polysiloxane, and (A-6) cardo based resin in a total of 100 mass% of the (A) alkali-soluble resin is within a range of 50 to 100 mass%.

[Claim 12] A negative-type photosensitive resin composition comprising an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator,

the negative-type photosensitive resin composition being characterized in that the (A) alkali-soluble resin contains one or more species of resins selected from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, and a (A-4) polybenzoxazole precursor, and

that a content ratio of a compound having five ethylenic unsaturated bond groups in a (B-1) molecule in a total of the (B) radical polymerizable compound is within a range of 51 to 99 mass%.

[Claim 13] A negative-type photosensitive resin composition comprising an (A) alkali-soluble resin, a (B) radical polymerizable compound, and a (C) photo initiator,

the negative-type photosensitive resin composition being characterized in that the (A) alkali-soluble resin contains one or more species of resins selected from a (A-1) polyimide, a (A-2) polybenzoxazole, a (A-3) polyimide precursor, and a (A-4) polybenzoxazole precursor, and

that the (A-1) polyimide, the (A-2) polybenzoxazole, the (A-3) polyimide precursor, and the (A-4) polybenzoxazole precursor in the (A) alkali-soluble resin contain a structural unit having a fluorine atom, in an amount of 30 to 100 mol% of entire structural units, and

that a content ratio of a compound having five ethylenic unsaturated bond groups in a (B-1) molecule in a total of the (B) radical polymerizable compound is within a range of 51 to 99 mass%.

[Claim 14] A cured film obtained by curing the negative-type photosensitive resin composition according to any one of Claims 1 to 13.

[Claim 15] A display device comprising the cured film according to Claim 14.

[Claim 16] The display device according to Claim 15, comprising a display unit having a curved surface, wherein a radius of curvature of the curved surface is within a range of 0.1 to 10 mm, and

wherein an optical density per 1 μm of the cured film thickness is within a range of 0.3 to 5.0, and

wherein a taper angle of an inclined side of a cross section of the cured pattern is within a range of 1 to 60°.

[Claim 17] A production method for a display device, comprising:

(1) a step of forming a film of the negative-type photosensitive resin composition according any one of Claims 1 to 13 on a substrate;

(2) a step of irradiating the negative-type photosensitive resin composition formed as the film with a chemical active ray via a photomask and then forming a

pattern by using an alkali solution; and

(3) a step of forming a cured pattern by heating the pattern.