the present disclosure is a negative-type photosensitive resin composition containing an (A1) first resin, a (A2) second resin, a (C) photopolymerization initiator, and a (D) coloring agent,

wherein the (A1) first resin is an (A1-1) polyimide and/or an (A1-2) polybenzo-oxazole, and

wherein the (A2) second resin is one or more species selected from a (A2-1) polyimide precursor, a (A2-2) polybenzo-oxazole precursor, a (A2-3) polysiloxane, a (A2-4) cardo based resin, and an (A2-5) acrylic resin, and

wherein a content ratio of the (A1) first resin in a total of 100 mass% of the (A1) first resin and the (A2) second resin is within the range of 25 to 90 mass%.

[0011a] In an aspect, there is provided a negative-type photosensitive resin composition comprising an (A1) first resin, a (A2) second resin, a (C) photopolymerization initiator, and a (D1) pigment as a (D) coloring agent,

wherein the (A1) first resin is an (A1-1) polyimide and/or an (A1-2) polybenzo-oxazole, and

wherein the (A2) second resin is one or more species selected from a (A2-1) polyimide precursor, a (A2-2) polybenzo-oxazole precursor, a (A2-3) polysiloxane, a (A2-4) cardo based resin, and an (A2-5) acrylic resin, and

wherein a content ratio of the (A1) first resin in a total of 100 mass% of the (A1) first resin and the (A2) second resin is within a range of 25 to 90 mass%, and

wherein the (D1) pigment contain a (D1a) black pigment, a content ratio of the (D1a) black pigment in an entire solid content is within a range of 5 to 70 mass%.

[0011b] In another aspect, there is provided a negative-type photosensitive resin composition comprising an (A1) first resin, a (A2) second resin, a (C) photopolymerization initiator, and a (D) coloring agent,

wherein the (A1) first resin is an (A1-1) polyimide and/or an (A1-2) polybenzo-oxazole, and

wherein the (A2) second resin is one or more species selected from a (A2-1) polyimide precursor, a (A2-2) polybenzo-oxazole precursor, a (A2-3) polysiloxane, a (A2-4) cardo based resin, and an (A2-5) acrylic resin, and

wherein a content ratio of the (A1) first resin in a total of 100 mass% of the (A1) first resin and the (A2) second resin is within a range of 25 to 90 mass%, and

wherein one or more species selected from the (A1-1) polyimide, the (A1-2) polybenzo-oxazole, the (A2-1) polyimide precursor, and the (A2-2) polybenzo-oxazole precursor contain a structural unit originating from a carboxylic acid that has a fluorine atom and/or a structural unit originating from a carboxylic acid derivative that has a fluorine atom, and

wherein the content ratio of a structural unit originating from a carboxylic acid that has a fluorine atom and/or a structural unit originating from a carboxylic acid derivative that has a fluorine atom in a structural unit originating from the entire carboxylic acids and their derivatives in a resin of one or more species selected from the (A1-1) polyimide, the (A1-2) polybenzo-oxazole, the (A2-1) polyimide precursor, and the (A2-2) polybenzo-oxazole precursor is within a range of 30 to 100 mol%.

[0011b] In another aspect, there is provided a cured film

obtained by curing the negative-type photosensitive resin composition as defined above.

[0011c] In another aspect, there is provided an element comprising the cured film as defined above.

[0011d] In another aspect, there is provided an organic EL display comprising the cured film as defined above, in at least one of a planarization layer on a drive circuit and an electrically insulating layer on a first electrode, pixel-separating layers, color filters, black matrixes, black column spacers, gate insulating films, interlayer insulating films, protection films for metal wiring, insulation films for metal wiring, planarization films for TFTs, TFT protective layers.

[0011e] In another aspect, there is provided a production method for an organic EL display, comprising:

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

(2) a step of irradiating the resin composition with a chemical active ray via a photomask;

(3) a step of performing development with an alkali solution so that a pattern of the resin composition is formed; and

(4) a step of heating the pattern so that a cured pattern of the resin composition is obtained.

[0011f] In another aspect, there is provided a production method for negative-type photosensitive resin composition as defined above, comprising:

a step of preparing a pigment dispersion liquid, in which a (D1) pigment is dispersed by using a dispersion machine in a mixture solution that contains an (A1) first resin and/or an

(A2) second resin, and an (E) dispersing agent,

a step of adding a mixture solution that contains a (B) radical polymerizable compound and a (C) photopolymerization initiator to the pigment dispersion liquid, and stirring the pigment dispersion liquid,

wherein the (D) coloring agent contains a (D1a-1a) benzofuranone based black pigment and/or a (D1a-1b) perylene based black pigment as a (D1a) black pigment,

wherein the (A1) first resin and/or the (A2) second resin is one or more species selected from an (A1-1) polyimide, an (A1-2) polybenzo-oxazole, a (A2-1) polyimide precursor, a (A2-2) polybenzo-oxazole precursor,

wherein the dispersion machine is a bead mill that has a separator based on a centrifugal separation system and a bead diameter of the bead mill is 0.01 to 6 mm.

Advantageous Effects

[0012] The negative-type photosensitive resin composition of the present disclosure makes it possible to obtain high-resolution and low-taper pattern shape and makes it possible to obtain a cured film excellent in heat resistance and light blocking property.

Brief Description of the Drawings

[0013] [Fig. 1] Figs. 1(1) to (7) are processing diagrams exemplifying a production process of an organic EL display that uses a cured film of a negative-type photosensitive resin composition of the present invention.

[Fig. 2] Figs. 2(1) to (13) are processing diagrams exemplifying a production process of a liquid crystal display that uses a cured film of a negative-type photosensitive resin composition

of the present invention.

[Fig. 3] Figs. 3(1) to (10) are processing diagrams exemplifying a production process of a flexible organic EL display that uses

Claims

[Claim 1] A negative-type photosensitive resin composition comprising an (A1) first resin, a (A2) second resin, a (C) photopolymerization initiator, and a (D1) pigment as a (D) coloring agent,

wherein the (A1) first resin is an (A1-1) polyimide and/or an (A1-2) polybenzo-oxazole, and

wherein the (A2) second resin is one or more species selected from a (A2-1) polyimide precursor, a (A2-2) polybenzo-oxazole precursor, a (A2-3) polysiloxane, a (A2-4) cardo based resin, and an (A2-5) acrylic resin, and

wherein a content ratio of the (A1) first resin in a total of 100 mass% of the (A1) first resin and the (A2) second resin is within a range of 25 to 90 mass%, and

wherein the (D1) pigment contain a (D1a) black pigment, a content ratio of the (D1a) black pigment in an entire solid content is within a range of 5 to 70 mass%.

[Claim 2] A negative-type photosensitive resin composition comprising an (A1) first resin, a (A2) second resin, a (C) photopolymerization initiator, and a (D) coloring agent,

wherein the (A1) first resin is an (A1-1) polyimide and/or an (A1-2) polybenzo-oxazole, and

wherein the (A2) second resin is one or more species selected from a (A2-1) polyimide precursor, a (A2-2) polybenzo-oxazole precursor, a (A2-3) polysiloxane, a (A2-4) cardo based resin, and an (A2-5) acrylic resin, and

wherein a content ratio of the (A1) first resin in a total of 100 mass% of the (A1) first resin and the (A2) second

resin is within a range of 25 to 90 mass%, and

wherein one or more species selected from the (A1-1) polyimide, the (A1-2) polybenzo-oxazole, the (A2-1) polyimide precursor, and the (A2-2) polybenzo-oxazole precursor contain a structural unit originating from a carboxylic acid that has a fluorine atom and/or a structural unit originating from a carboxylic acid derivative that has a fluorine atom, and

wherein the content ratio of a structural unit originating from a carboxylic acid that has a fluorine atom and/or a structural unit originating from a carboxylic acid derivative that has a fluorine atom in a structural unit originating from the entire carboxylic acids and their derivatives in a resin of one or more species selected from the (A1-1) polyimide, the (A1-2) polybenzo-oxazole, the (A2-1) polyimide precursor, and the (A2-2) polybenzo-oxazole precursor is within a range of 30 to 100 mol%.

[Claim 3] The negative-type photosensitive resin composition according to Claim 1 or 2,

wherein a (D) coloring agent contains a (D1a) black pigment, the (D1a) black pigment contains a (D1a-1a) benzofuranone based black pigment and/or a (D1a-1b) perylene based black pigment as a (D1a-1) black organic pigment.

[Claim 4] The negative-type photosensitive resin composition according to any one of Claims 1 to 3,

wherein a (D) coloring agent contains a (D1a-3) mixture of two or more coloring pigments, the (D1a-3) mixture of two or more coloring pigments contains two or more color pigments selected from white, red, orange, yellow, green, blue, and violet pigments.

[Claim 5] The negative-type photosensitive resin composition according to any one of Claims 1 to 4, comprising a (B) radical polymerizable compound, wherein the content ratio of the (B) radical polymerizable compound in a total of 100 mass parts of the (A1) first resin, the (A2) second resin, the (B) radical polymerizable compound is 15 to 65 mass parts.

[Claim 6] The negative-type photosensitive resin composition according to any one of Claims 1 to 5,

wherein the (C) photopolymerization initiator contains one or more species selected from

1-[9-ethyl-6-(2-methylbenzoyl)-9H-carbazol-3-yl]ethanone-1-(O-acetyl)oxime,

1-[9-ethyl-6-[2-methyl-4-[1-(2,2-dimethyl-1,3-dioxolane-4-yl)methyl

oxy]benzoyl]-9H-carbazol-3-yl]ethanone-1-(O-acetyl)oxime,

1-(9-ethyl-6-nitro-9H-carbazol-3-yl)-1-[2-methyl-4-(1-methoxypropane-2-yloxy)phenyl]methanone-1-(O-acetyl)oxime.

[Claim 7] The negative-type photosensitive resin composition according to any one of Claims 1 to 6, further comprising a (B) radical polymerizable compound, wherein the radical polymerizable compound contains one or more species selected from dipentaerythritol penta(meth)acrylate, dipentaerythritol hexa(meth)acrylate, tripentaerythritol hepta(meth)acrylate, tripentaerythritol octa(meth)acrylate, tetrapentaerythritol nona(meth)acrylate, tetrapentaerythritol deca(meth)acrylate, pentapentaerythritol undeca(meth)acrylate,

pentapentaerythritol deca(meth)acrylate, their acid-modified products, their ethylene oxide-modified products, or their propylene oxide-modified products.

[Claim 8] The negative-type photosensitive resin composition according to any one of Claims 1 to 7,

wherein one or more species selected from the (A1-1) polyimide, the (A1-2) polybenzo-oxazole, the (A2-1) polyimide precursor, and the (A2-2) polybenzo-oxazole precursor contain a structural unit originating from an amine having an oxyalkylene structure and/or an amine derivative having an oxyalkylene structure.

[Claim 9] The negative-type photosensitive resin composition according to any one of Claims 1 to 8, further comprising a thiol based chain transfer agent and /or a the thioxanthone based sensitivity enhancing agent.

[Claim 10] The negative-type photosensitive resin composition according to any one of Claims 1 to 9, further comprising a (E) dispersing agent, wherein the (E) dispersing agent contains one or more species selected from a dispersing agent that has an amine value alone, a dispersing agent that has an amine value and an acid value, a dispersing agent that has an acid value alone, or a dispersing agent that has 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 (E) dispersing agent contains one or more polymer chain selected acrylic resin based dispersing agents, polyoxyalkylene ether based dispersing agents, polyester based dispersing agents, polyurethane based dispersing agents, polyol based dispersing agents, polyethylene imine based dispersing agents, or polyallylamine based dispersing agents.

[Claim 11] The negative-type photosensitive resin composition according to any one of Claims 1 to 10,

wherein one or more species selected from the (A1-1) polyimide, the (A1-2) polybenzo-oxazole, the (A2-1) polyimide precursor, and the (A2-2) polybenzo-oxazole precursor contain a structural unit originating from a diamine that has a fluorine atom and/or a structural unit originating from a diamine derivative that has a fluorine atom, and

wherein the content ratio of the structural unit originating from a diamine that has a fluorine atom and/or the structural unit originating from a diamine derivative that has a fluorine atom in a structural unit originating from entire amines and their derivatives in a resin of one or more species selected from the (A1-1) polyimide, the (A1-2) polybenzo-oxazole, the (A2-1) polyimide precursor, and the (A2-2) polybenzo-oxazole precursor is within a range of 30 to 100 mol%.

[Claim 12] A cured film obtained by curing the negative-type photosensitive resin composition according to any one of Claims 1 to 11.

[Claim 13] The cured film according to Claim 12, wherein an optical density per 1 μm of film thickness is within a range of 0.3 to 5.0, and

wherein the cured film comprises a cured pattern, and a taper angle of an inclined side of a sectional surface of the cured pattern is within a range of 1 to 60°.

[Claim 14] An element comprising the cured film according

to Claim 12 or 13.

[Claim 15] An organic EL display comprising the cured film according to Claim 12 or 13, in at least one of a planarization layer on a drive circuit and an electrically insulating layer on a first electrode, pixel-separating layers, color filters, black matrixes, black column spacers, gate insulating films, interlayer insulating films, protection films for metal wiring, insulation films for metal wiring, planarization films for TFTs, TFT protective layers.

[Claim 16] The organic EL display according to Claim 15, being (1) an organic EL display that does not comprises a liquid crystal layer, wherein light output from a display surface of the organic EL display apparatus is non-polarized light, or (2) an organic EL display that comprises a liquid crystal layer, wherein light output from a display surface of the organic EL display apparatus is polarized light output from the liquid crystal layer,

wherein the organic EL display does not form a polarizing plate and a quarter-wavelength plate at the light extraction side of the light-emitting elements.

[Claim 17] The organic EL display according to Claim 15 or 16, comprising a structure stacked on a flexible substrate, wherein a carbon atom content ratio in a material that forms the flexible substrate is within a range of 20 to 100 mass%, and the flexible substrate comprises ploy imide.

[Claim 18] The organic EL display according to any one of Claims 15 to 17, further comprises an oxide of one or more species selected from indium, tin, zinc, aluminum, and gallium, a metal (molybdenum, silver, copper, aluminum, gallium.

[Claim 19] A production method for an organic EL display, comprising:

(1) a step of forming a coating film of the negative-type photosensitive resin composition according to any one of Claims 1 to 11 on a substrate;

(2) a step of irradiating the resin composition with a chemical active ray via a photomask;

(3) a step of performing development with an alkali solution so that a pattern of the resin composition is formed; and

(4) a step of heating the pattern so that a cured pattern of the resin composition is obtained.

[Claim 20] A production method for negative-type photosensitive resin composition according to Claims 10, comprising:

a step of preparing a pigment dispersion liquid, in which a (D1) pigment is dispersed by using a dispersion machine in a mixture solution that contains an (A1) first resin and/or an (A2) second resin, and an (E) dispersing agent,

a step of adding a mixture solution that contains a (B) radical polymerizable compound and a (C) photopolymerization initiator to the pigment dispersion liquid, and stirring the pigment dispersion liquid,

wherein the (D) coloring agent contains a (D1a-1a) benzofuranone based black pigment and/or a (D1a-1b) perylene based black pigment as a (D1a) black pigment,

wherein the (A1) first resin and/or the (A2) second resin is one or more species selected from an (A1-1) polyimide, an (A1-2) polybenzo-oxazole, a (A2-1) polyimide precursor, a (A2-2) polybenzo-oxazole precursor,

wherein the dispersion machine is a bead mill that has a separator based on a centrifugal separation system and a bead diameter of the bead mill is 0.01 to 6 mm.