CLAIMS

[Claim 1]

A negative type photosensitive resin composition comprising, as an alkali-soluble resin (A), at least a weakly acidic group-containing resin (A1), an unsaturated group-containing resin (A2), a radical-polymerizable compound (B) and a photosensitive agent (C),

the weakly acidic group-containing resin (A1) containing an acidic group having an acid dissociation constant in the range of 13.0 to 23.0 in dimethyl sulfoxide, and

the unsaturated group-containing resin (A2) having an ethylenically unsaturated double bond group;

wherein the weakly acidic group-containing resin (A1) includes one or more selected from the group consisting of polyimide (A1a-1), polyimide precursor (A1a-2), carboxylic acid-modified polysiloxane (A1a-3), polybenzoxazole (A1b-1), polybenzoxazole precursor (A1b-2), and polysiloxane (A1b-3).

[Claim 2]

A negative type photosensitive resin composition as set forth in claim 1, wherein the weakly acidic group-containing resin (A1) includes a double acidic group-containing resin (A1a) and a weakly acidic group-containing second resin (A1b), and

the double acidic group-containing resin (A1a) includes one or more selected from the group consisting of the following as described later: polyimide (A1a-1), polyimide precursor (A1a-2), carboxylic acid-modified polysiloxane (A1a-3), carboxylic acid-modified novolac resin (A1a-4), and carboxylic acid-modified polyhydroxystyrene (A1a-5), and

the weakly acidic group-containing second resin (A1b) includes one or more selected from the group consisting of the following as described later: polybenzoxazole (A1b-1), polybenzoxazole precursor (A1b-2), polysiloxane (A1b-3), novolac resin (A1b-4), and polyhydroxystyrene (A1b-5).

[Claim 3]

A negative type photosensitive resin composition as set forth in either claim 1 or 2, wherein the weakly acidic group-containing resin (A1) having one or more acidic groups selected from the group consisting of phenolic hydroxyl group, silanol group, hydroxyimide group, and hydroxyamide group.

[Claim 4]

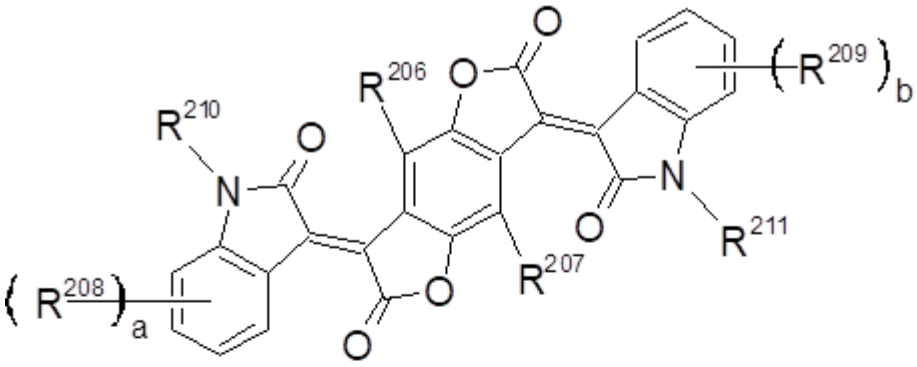
A negative type photosensitive resin composition as set forth in any one of claims 1 to 3 further comprising a coloring agent (D).

[Claim 5]

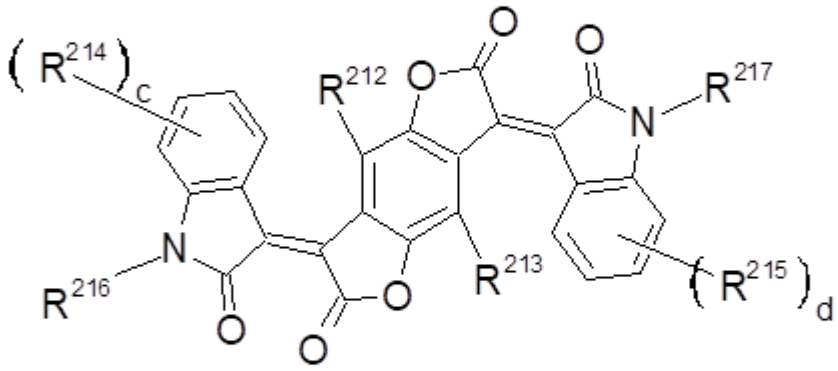
A negative type photosensitive resin composition as set forth in claim 4, wherein the coloring agent (D) contains a pigment (D1), and the pigment (D1) contains a black pigment (D1a).

[Claim 6]

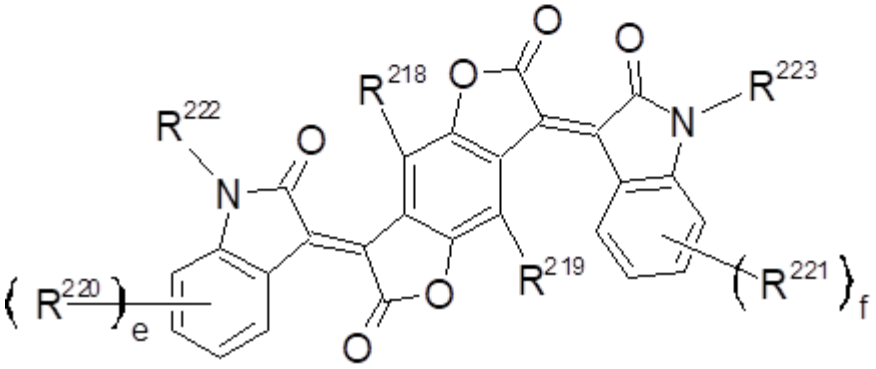
A negative type photosensitive resin composition as set forth in claim 5, wherein the black pigment (D1a) contains a benzofuranone based black pigment (D1a-1a) and/or a perylene based black pigment (D1a-1b) as a black organic pigment (D1a-1), and
the benzofuranone based black pigment (D1a-1a) includes a benzofuranone compound as represented by any of general formulae (63) to (68), a geometrical isomer thereof, a salt thereof, or a geometrical isomer salt thereof, and
the perylene based black pigment (D1a-1b) includes a perylene compound as represented by any of general formulae (69) to (71), a geometrical isomer thereof, a salt thereof, or a geometrical isomer salt thereof;



(63)



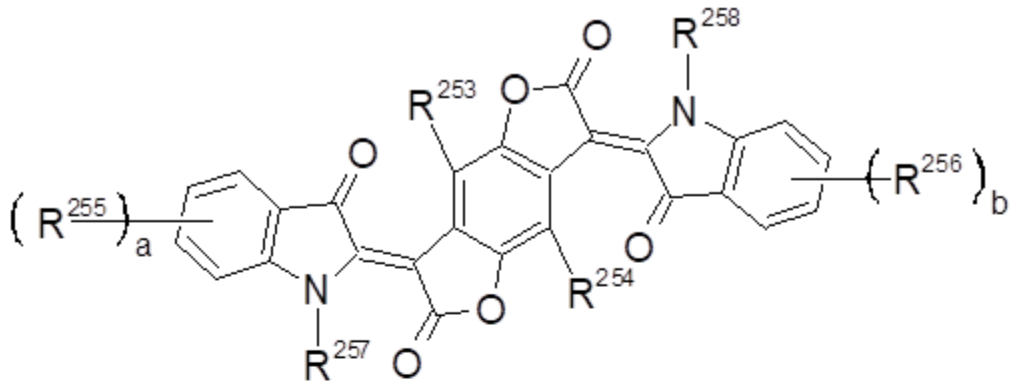
(64)



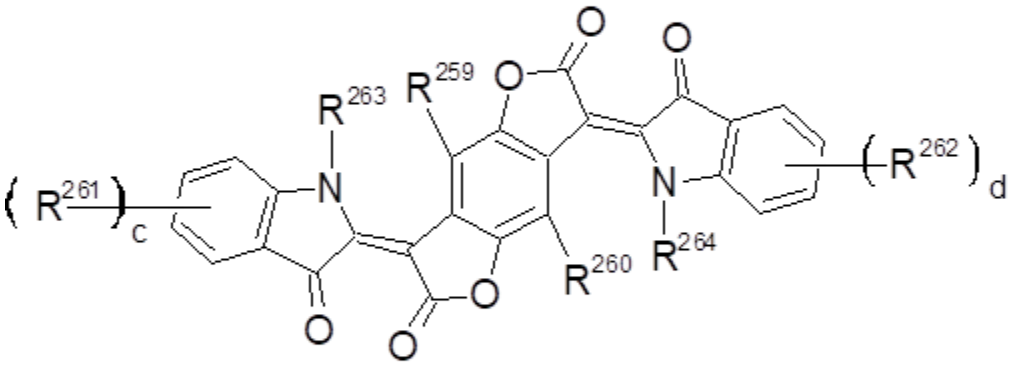
(65)

wherein in general formulae (63) to (65), R^{206}, R^{207}, R^{212}, R^{213}, R^{218}, and R^{219} are each independently a hydrogen atom, a halogen atom, an alkyl group containing 1 to 10 carbon atoms, or an alkyl group containing 1 to 10 carbon atoms and 1 to 20 fluorine atoms; R^{208},

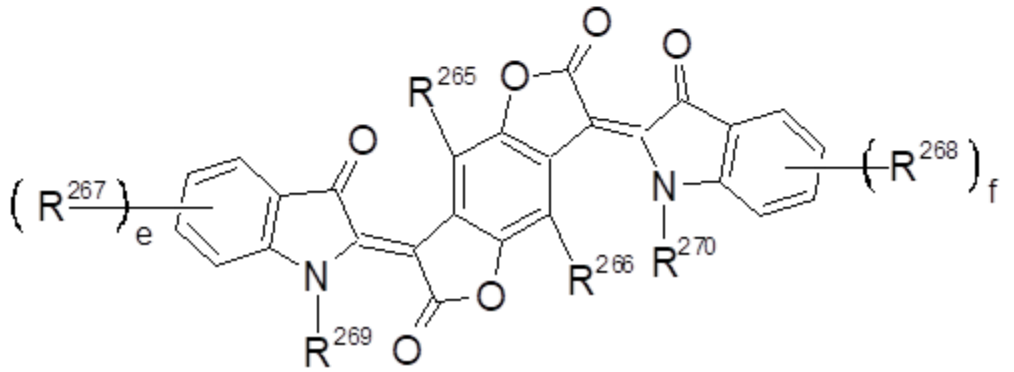
R^{209}, R^{214}, R^{215}, R^{220}, and R^{221} are each independently a hydrogen atom, a halogen atom, R^{251}, COOH, $COOR^{251}$, COO-, $CONH_2$, $CONHR^{251}$, $CONR^{251}R^{252}$, CN, OH, OR^{251}, $OCOR^{251}$, $OCONH_2$, $OCONHR^{251}$, $OCONR^{251}R^{252}$, NO_2, NH_2, NHR^{251}, $NR^{251}R^{252}$, $NHCOR^{251}$, $NR^{251}COR^{252}$, $N=CH_2$, $N=CHR^{251}$, $N=CR^{251}R^{252}$, 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} are each independently an alkyl group containing 1 to 10 carbon atoms, a cycloalkyl group containing 4 to 10 carbon atoms, an alkenyl group containing 2 to 10 carbon atoms, a cycloalkenyl group containing 4 to 10 carbon atoms, or alkynyl group containing 2 to 10 carbon atoms; a plurality selected from R^{208}, R^{209}, R^{214}, R^{215}, R^{220}, and R^{221} may be connected by a direct bond, oxygen atom bridge, sulfur atom bridge, NH bridge, or NR^{251} bridge to form a ring; R^{210}, R^{211}, R^{216}, R^{217}, R^{222}, and R^{223} are each independently a hydrogen atom, an alkyl group containing 1 to 10 carbon atoms, or an aryl group containing 6 to 15 carbon atoms; and furthermore, a, b, c, d, e, and f are each independently an integer of 0 to 4;



(66)



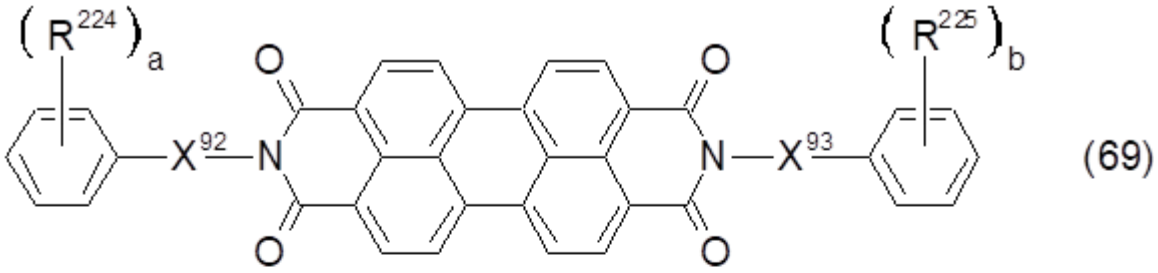
(67)



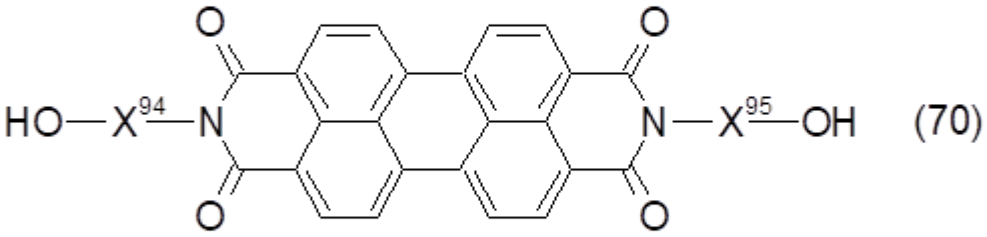
(68)

wherein in general formulae (66) to (68), R^{253}, R^{254}, R^{259}, R^{260}, R^{265}, and R^{266} are each independently a hydrogen atom, a halogen atom, an alkyl group containing 1 to 10 carbon atoms, or an alkyl group containing 1 to 10 carbon atoms and 1 to 20 fluorine atoms; R^{255}, R^{256}, R^{261}, R^{262}, R^{267}, and R^{268} are each independently a hydrogen atom, a 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} are each independently an alkyl group containing 1 to 10 carbon atoms, a cycloalkyl group containing 4 to 10 carbon atoms, an alkenyl group containing 2 to 10 carbon atoms, a cycloalkenyl group containing 4 to 10 carbon atoms, or alkynyl group containing 2 to 10 carbon atoms; a plurality selected from R^{255}, R^{256}, R^{261}, R^{262}, R^{267}, and R^{268} may be connected by a direct

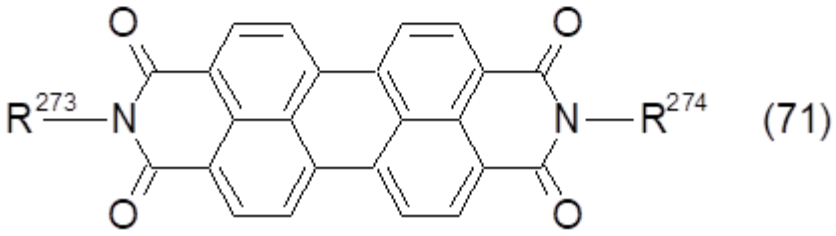
bond, oxygen atom bridge, sulfur atom bridge, NH bridge, or NR^{271} bridge to form a ring; R^{257}, R^{258}, R^{263}, R^{264}, R^{269}, and R^{270} are each independently a hydrogen atom, an alkyl group containing 1 to 10 carbon atoms, or an aryl group containing 6 to 15 carbon atoms; and furthermore, a, b, c, d, e, and f are each independently an integer of 0 to 4;



(69)



(70)



(71)

wherein in general formulae (69) to (71), X^{92}, X^{93}, X^{94}, and X^{95} are each independently an alkylene chain containing 1 to 10 carbon atoms; R^{224} and R^{225} are each independently a hydrogen atom, a hydroxyl group, an alkoxy group containing 1 to 6 carbon atoms, or an acyl group containing 2 to 6 carbon atoms; R^{273} and R^{274} are each independently a hydrogen atom or an alkyl group containing 1 to 10 carbon atoms; and furthermore, a and b are each an integer of 0 to 5.

[Claim 7]

A negative type photosensitive resin composition as set forth in claim 6, wherein the black organic pigment (D1a-1) contains the benzofuranone based black pigment (D1a-1a).

[Claim 8]

A negative type photosensitive resin composition as set forth in any one of claims 1 to 7, wherein the unsaturated group-containing resin (A2) includes one or more selected from the group consisting of unsaturated group-containing polyimide (A2a-1), unsaturated group-containing polyimide precursor (A2a-2), carboxylic acid-modified unsaturated group-containing polysiloxane (A2a-3), unsaturated group-containing polybenzoxazole (A2b-1),

unsaturated group-containing polybenzoxazole precursor (A2b-2), unsaturated group-containing polysiloxane (A2b-3), polycyclic side chain-containing aromatic resin (A2c-1), acrylic resin (A2c-2), and carboxylic acid-modified epoxy resin (A2c-3).

[Claim 9]

A negative type photosensitive resin composition as set forth in claim 8, wherein the unsaturated group-containing resin (A2) includes one or more selected from the group consisting of unsaturated group-containing polyimide (A2a-1), unsaturated group-containing polyimide precursor (A2a-2), carboxylic acid-modified unsaturated group-containing polysiloxane (A2a-3), unsaturated group-containing polybenzoxazole (A2b-1), unsaturated group-containing polybenzoxazole precursor (A2b-2), and unsaturated group-containing polysiloxane (A2b-3).

[Claim 10]

A negative type photosensitive resin composition as set forth in any one of claims 1 to 9, wherein the weakly acidic group-containing resin (A1) having no ethylenically unsaturated double bond group, and

the weakly acidic group-containing resin (A1) accounting for 30 to 99 mass% of the alkali-soluble resin (A).

[Claim 11]

A negative type photosensitive resin composition as set forth in claim 10, wherein the weakly acidic group-containing resin (A1) accounts for 70 to 97 mass% of the alkali-soluble resin (A).

[Claim 12]

A cured film formed by curing a negative type photosensitive resin composition as set forth in any one of claims 1 to 11.

[Claim 13]

A cured film as set forth in claim 12, wherein the optical density per micrometer of film thickness of the cured film is in the range of 0.3 to 5.0, and the cured film includes the step-shaped cured pattern.

[Claim 14]

A cured film as set forth in claim 13, wherein the film thickness difference ($\Delta T_{FT\text{-}HT}$) μm between (T_{FT}) and (T_{HT}) wherein (T_{FT}) μm denotes the film thickness of the thick parts and (T_{HT}) μm denotes the film thickness of the thin parts in the stepped shape of the cured pattern is in the range of 1.0 to 10.0 μm.

[Claim 15]

A cured film as set forth in claim 14, wherein (T_{FT}) and (T_{HT}) further meet the relations represented by general formulae (δ) to (ζ):

$3.0 \leq (T_{FT}) \leq 9.0$ (δ)

$0.20 \leq (T_{HT}) \leq 7.0$ (ε)

$0.20 \times (T_{FT}) \leq (T_{HT}) \leq 0.70 \times (T_{FT})$ (ζ)

[Claim 16]

A cured film as set forth in any one of claims 13 to 15, wherein an inclined slope in the cross section of a cured pattern having the step-shaped cured pattern has a taper angle in a range of 1° to 60°.

[Claim 17]

An organic EL display device comprising a cured film as set forth in any one of claims 12 to 16, wherein the cured film serves as at least one selected from pixel dividing layers, color filters, black matrices of color filters, and planarization films for TFTs.

[Claim 18]

An organic EL display device as set forth in claim 17 comprising a curved display part having a curvature radius in the range of 0.1 to 10 mm.

[Claim 19]

An organic EL production method for display device comprising:

(1) a step for forming a coating film of a negative type photosensitive resin composition as set forth in any one of claims 1 to 11 on a substrate,

(2) a step for applying active actinic ray to the resin composition through a photomask,

(3) a step for developing it with an alkaline solution to form a step-shaped pattern of the resin composition, and,

(4) a step for heating the pattern to produce a step-shaped cured pattern of the resin composition,

the photomask being halftone photomask that has a pattern containing transparent portions and light blocking portions and that also has translucent portions lower in transmittance than the transparent portions, higher in transmittance than the light blocking portions, and located between the transparent portions and the light blocking portions.