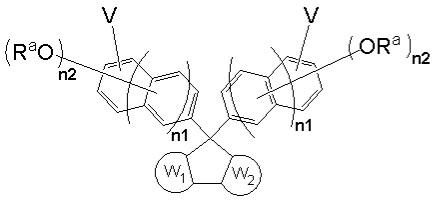
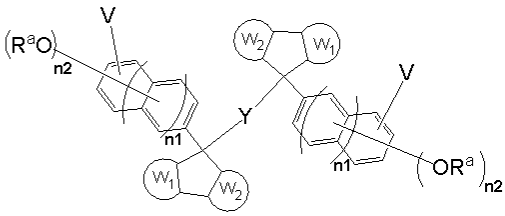
CLAIMS

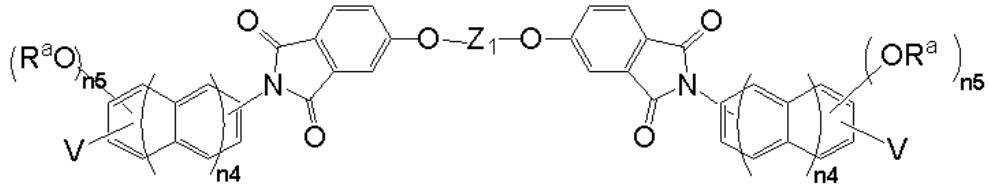
[Claim 1] A wafer edge protection film forming method for forming a protection film on a peripheral edge of a substrate, comprising the steps of:
(i) coating a peripheral edge of the substrate with a composition for forming a protection film comprising an aromatic ring-containing resin (A) having at least one of the constituent units represented by the following general formulae (A-1), (A-2), (A-3), (A-4), and (A-5), and a solvent; and
(ii) curing the applied composition for forming a protection film by heat or optical irradiation to form the protection film on the peripheral edge of the substrate,


(A-1)

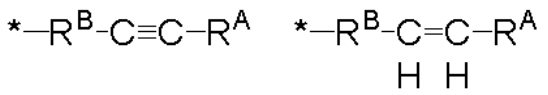

(A-2)

wherein W_1 and W_2 each independently represent a benzene ring or a naphthalene ring, and hydrogen atoms in the benzene ring and the naphthalene ring are optionally substituted with a hydrocarbon group having 1 to 6 carbon atoms; R^a represents a hydrogen atom or an organic group represented by the following general formula (2), and satisfies a relationship $e+f=1$ and $0.1 \leq f \leq 0.9$, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; Y is a group represented by the following general formula (3); n_1 is 0 or 1; n_2 is 1 or 2; and V independently represents a hydrogen atom or

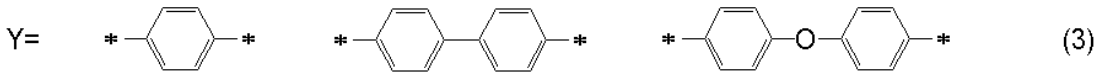
a connection portion,



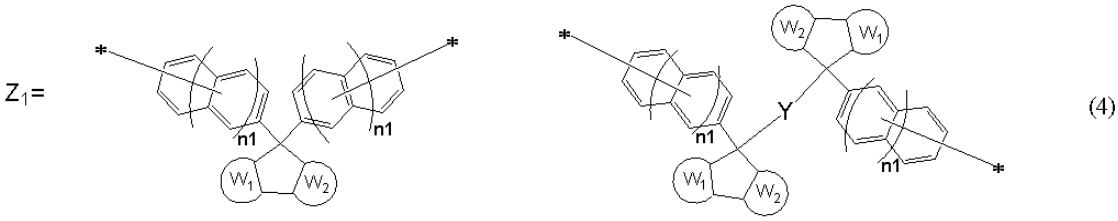
wherein Z_1 is a group represented by the following general formula (4), and R^a represents a hydrogen atom or an organic group represented by the following general formula (2) and satisfies a relationship e+f=1 and $0.1 \leq f \leq 0.9$, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; n_4 is 0 or 1, n_5 is 1 or 2, and V independently represents a hydrogen atom or a connection portion,



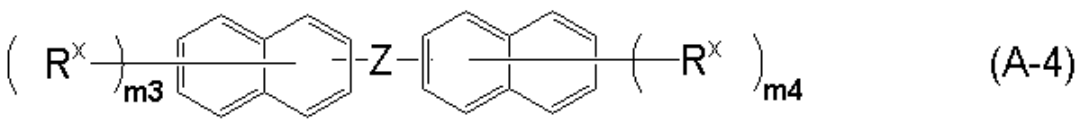
wherein * represents a site bonded with the oxygen atom, R^B represents a divalent organic group having 1 to 10 carbon atoms, and R^A represents a hydrogen atom or a monovalent organic group having 1 to 10 carbon atoms,



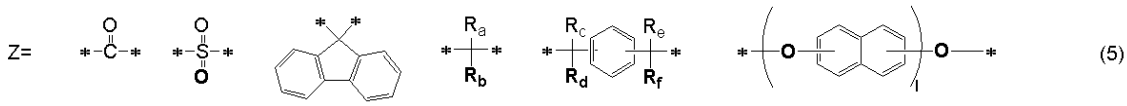
wherein * represents a bonding arm,



wherein W_1, W_2, Y, and n_1 are as defined above,

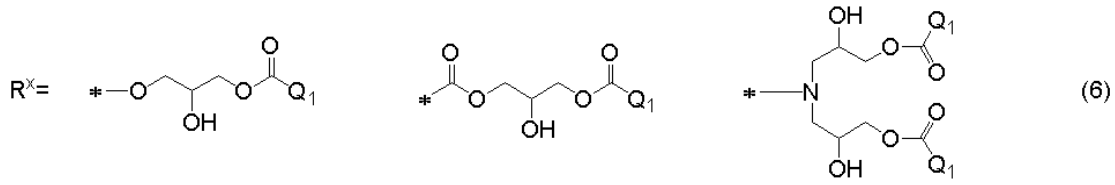


wherein m_3 and m_4 represent 1 or 2; Z represents either a single bond or the structure represented by the following general formula (5); and R^X is any one of the structures represented by the following general formula (6),



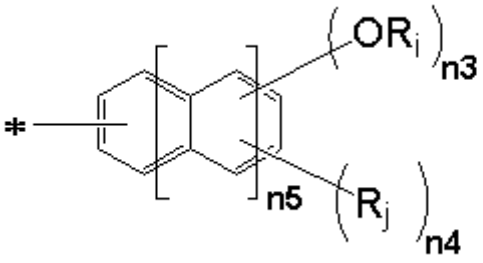
(5)

wherein * represents a bonding arm; l represents an integer of 0 to 3; R_a to R_f each independently represent a hydrogen atom or an optionally fluorine-substituted alkyl group having 1 to 10 carbon atoms, an optionally fluorine-substituted phenyl group, or an optionally fluorine-substituted phenylethyl group, and R_a and R_b may be bonded to each other to form a cyclic compound,



(6)

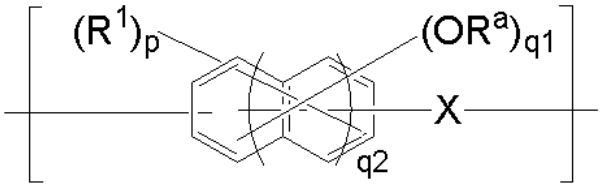
wherein * represents a site bonded with the aromatic ring; Q_1 is a linear saturated hydrocarbon group having 1 to 30 carbon atoms, or the structure represented by the following general formula (7),



(7)

wherein * represents a site bonded with the carbonyl group; R_i represents a hydrogen atom or the organic group represented by the general formula (2), and satisfies a relationship $e+f=1$ and $0.1 \leq f \leq 0.9$, wherein "e" represents

the proportion of the hydrogen atom and “f” represents the proportion of the organic group represented by the general formula (2) among the structures constituting R_i; R_j represents a linear or branched hydrocarbon group having 1 to 10 carbon atoms, a halogen atom, a nitro group, an amino group, a nitrile group, an alkoxycarbonyl group having 1 to 10 carbon atoms, or an alkanoyloxy group having 1 to 10 carbon atoms; n_3 and n_4 are each an integer of 0 to 7 that represents the number of substituents on the aromatic ring, provided that n_3 + n_4 is 0 or more and 7 or less; and n_5 represents 0 to 2,



(A-5)

wherein R^1 represents a saturated monovalent organic group having 1 to 30 carbon atoms or an unsaturated monovalent organic group having 2 to 30 carbon atoms; X is a divalent organic group having 1 to 30 carbon atoms; and R^a represents a hydrogen atom or the organic group represented by the general formula (2), and satisfies a relationship e+f=1 and 0.1≤f≤0.9, wherein “e” represents the proportion of the hydrogen atom and “f” represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; p is an integer of 0 to 5; q_1 is an integer of 1 to 6; p+q_1 is an integer of 1 or more and 6 or less; and q_2 is 0.

[Claim 2] The wafer edge protection film forming method according to claim 1, wherein the resin (A) is an aromatic ring-containing resin having a hydroxyl group

and an organic group represented by the following general formula (1A), and the ratio of the number of the hydroxyl groups to the number of the organic groups represented by the general formula (1A) satisfies a relationship c+d=1 and 0.1≤d≤0.9 wherein "c" represents the proportion of the hydroxyl group and "d" represents the proportion of the organic group represented by the general formula (1A).


(1A)

wherein * represents a bonding site.

[Claim 3] The wafer edge protection film forming method according to claim 1, wherein the resin (A) is a compound having a ratio Mw/Mn (i.e., dispersity) in a range of 1.00≤Mw/Mn≤1.25, the Mw/Mn being a ratio of the weight average molecular weight Mw to the number average molecular weight Mn on polystyrene basis according to gel permeation chromatography.

[Claim 4] The wafer edge protection film forming method according to claim 1, wherein the resin (A) is a polymer having a weight average molecular weight on polystyrene basis according to gel permeation chromatography of 1,000 to 12,000.

[Claim 5] The wafer edge protection film forming method according to claim 1, wherein the content of the resin (A) in the composition for forming a protection film is 10% by mass or more.

[Claim 6] The wafer edge protection film forming method

according to claim 1, wherein the composition for forming a protection film further comprises one or more of a crosslinking agent, a high boiling point solvent, a surfactant, an acid generator, and a plasticizer.

[Claim 7] The wafer edge protection film forming method according to any one of claims 1 to 6, wherein, in the step (i), in addition to the peripheral edge on the surface side of the substrate, the composition for forming a protection film is applied also to the peripheral edge on the backside of the substrate, thereby forming the protection film also on the peripheral edge on the backside of the substrate in the step (ii).

[Claim 8] The wafer edge protection film forming method according to any one of claims 1 to 6, wherein the coating in the step (i) is performed using a spin coating method, and the protection film is not formed on areas other than the peripheral edge on the surface side of the substrate and the peripheral edge on the backside of the substrate.

[Claim 9] The wafer edge protection film forming method according to any one of claims 1 to 6, wherein, in the step (ii), the applied composition for forming a protection film is cured by heat treatment at a temperature of 100°C or more and 800°C or less for 10 seconds to 7,200 seconds.

[Claim 10] A patterning process for forming a protection film on a peripheral edge of a substrate to be processed on which a film with a pattern is formed, and forming a

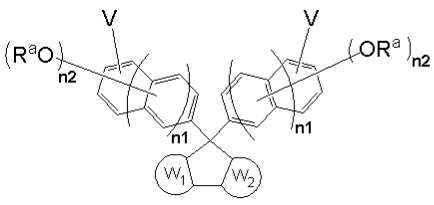
pattern on the substrate to be processed, the patterning process comprising the steps of:

(I-1) applying a composition for forming a protection film comprising an aromatic ring-containing resin (A) having at least one of the constituent units represented by the following general formulae (A-1), (A-2), (A-3), (A-4), and (A-5) and a solvent to a peripheral edge of a substrate to be processed on which a film with a pattern is formed;

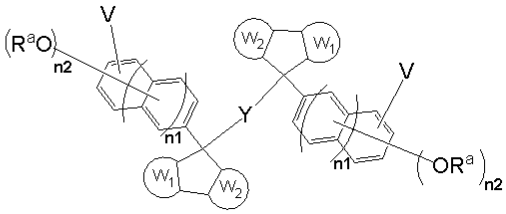
(I-2) curing the applied composition for forming a protection film by a heat treatment or optical irradiation to form a protection film on the peripheral edge of the substrate;

(I-3) forming a pattern on the substrate to be processed by dry etching while using the film with a pattern as a mask; and

(I-4) removing the protection film,



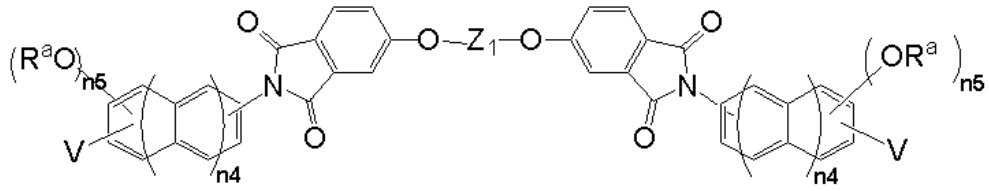
(A-1)



(A-2)

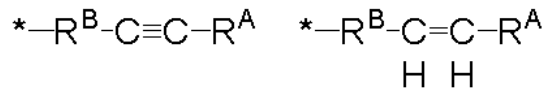
wherein W_1 and W_2 each independently represent a benzene ring or a naphthalene ring, and hydrogen atoms in the benzene ring and the naphthalene ring are optionally substituted with a hydrocarbon group having 1 to 6 carbon atoms; R^a represents a hydrogen atom or an organic group represented by the following general formula (2), and satisfies a relationship $e+f=1$ and $0.1 \leq f \leq 0.9$, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; Y is a group represented by

the following general formula (3); n_1 is 0 or 1; n_2 is 1 or 2; and V independently represents a hydrogen atom or a connection portion,



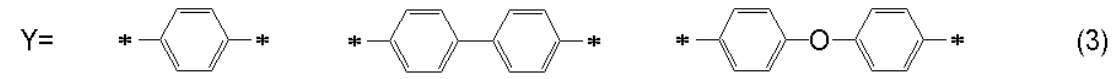
(A-3)

wherein Z_1 is a group represented by the following general formula (4), and R^a represents a hydrogen atom or an organic group represented by the following general formula (2) and satisfies a relationship e+f=1 and $0.1 \leq f \leq 0.9$, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; n_4 is 0 or 1, n_5 is 1 or 2, and V independently represents a hydrogen atom or a connection portion,



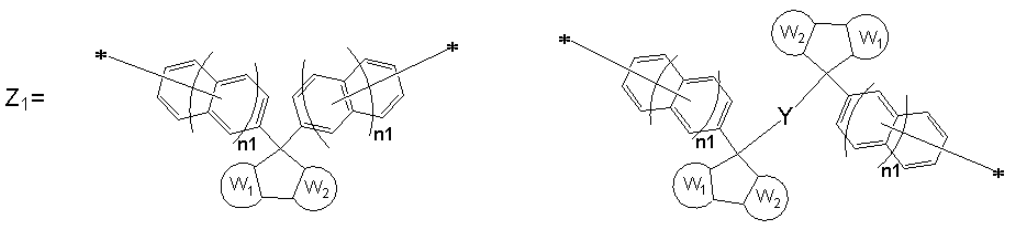
(2)

wherein * represents a site bonded with the oxygen atom, R^B represents a divalent organic group having 1 to 10 carbon atoms, and R^A represents a hydrogen atom or a monovalent organic group having 1 to 10 carbon atoms,



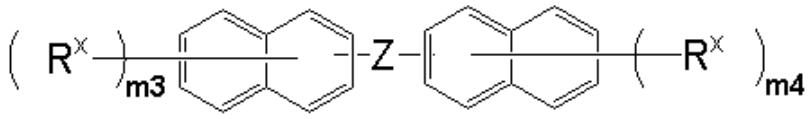
(3)

wherein * represents a bonding arm,



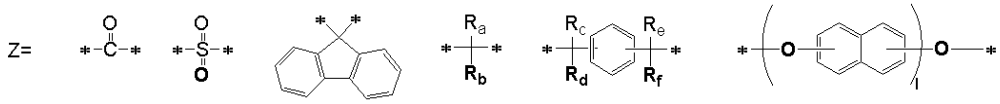
(4)

wherein W_1, W_2, Y, and n_1 are as defined above,



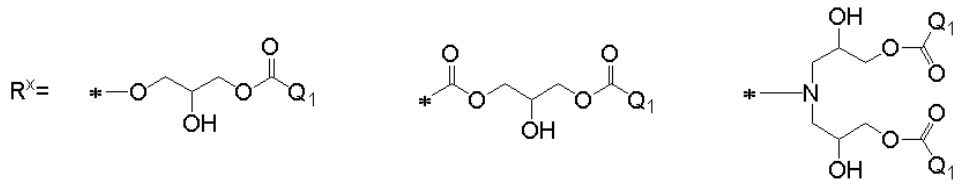
(A-4)

wherein m_3 and m_4 represent 1 or 2; Z represents either a single bond or the structure represented by the following general formula (5); and R^X is any one of the structures represented by the following general formula (6),



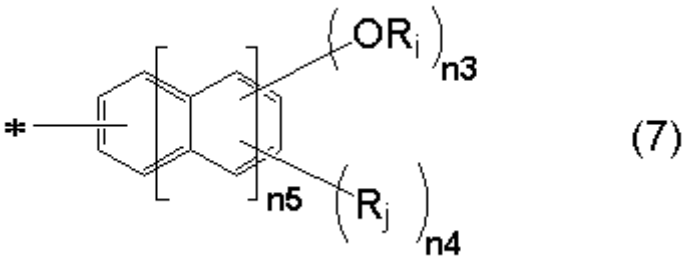
(5)

wherein * represents a bonding arm; l represents an integer of 0 to 3; R_a to R_f each independently represent a hydrogen atom or an optionally fluorine-substituted alkyl group having 1 to 10 carbon atoms, an optionally fluorine-substituted phenyl group, or an optionally fluorine-substituted phenylethyl group, and R_a and R_b may be bonded to each other to form a cyclic compound,



(6)

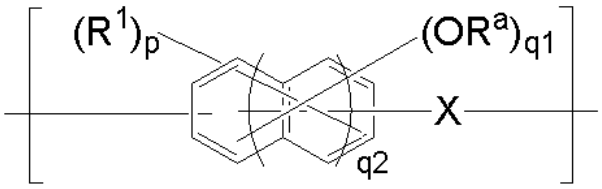
wherein * represents a site bonded with the aromatic ring; Q_1 is a linear saturated hydrocarbon group having 1 to 30 carbon atoms, or the structure represented by the following general formula (7),



(7)

wherein * represents a site bonded with the carbonyl

group; R_i represents a hydrogen atom or the organic group represented by the general formula (2), and satisfies a relationship e+f=1 and 0.1≤f≤0.9, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R_i; R_j represents a linear or branched hydrocarbon group having 1 to 10 carbon atoms, a halogen atom, a nitro group, an amino group, a nitrile group, an alkoxycarbonyl group having 1 to 10 carbon atoms, or an alkanoyloxy group having 1 to 10 carbon atoms; n_3 and n_4 are each an integer of 0 to 7 that represents the number of substituents on the aromatic ring, provided that n_3 + n_4 is 0 or more and 7 or less; and n_5 represents 0 to 2,



(A-5)

wherein R^1 represents a saturated monovalent organic group having 1 to 30 carbon atoms or an unsaturated monovalent organic group having 2 to 30 carbon atoms; X is a divalent organic group having 1 to 30 carbon atoms; and R^a represents a hydrogen atom or the organic group represented by the general formula (2), and satisfies a relationship e+f=1 and 0.1≤f≤0.9, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; p is an integer of 0 to 5; q_1 is an integer of 1 to 6; $p+q_1$ is an integer of 1 or more and 6 or less; and q_2 is 0.

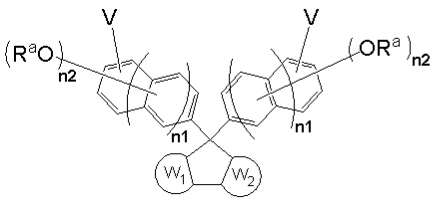
[Claim 11] A patterning process for forming a protection film on a peripheral edge of a substrate to be processed, and forming a pattern on the substrate to be processed, the patterning process comprising the steps of:

(II-1) applying a composition for forming a protection film comprising an aromatic ring-containing resin (A) having at least one of the constituent units represented by the following general formulae (A-1), (A-2), (A-3), (A-4), and (A-5) and a solvent to a peripheral edge of a substrate to be processed;

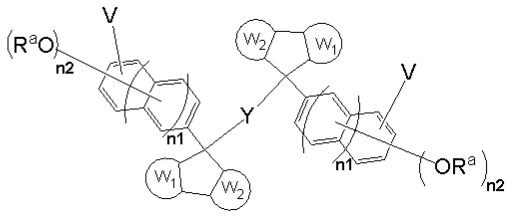
(II-2) curing the applied composition for forming a protection film by a heat treatment or optical irradiation to form a protection film on the peripheral edge of the substrate to be processed;

(II-3) forming a resist upper layer film pattern on the substrate to be processed and forming a pattern on the substrate to be processed by dry etching while using the resist upper layer film pattern as a mask; and

(II-4) removing the protection film,



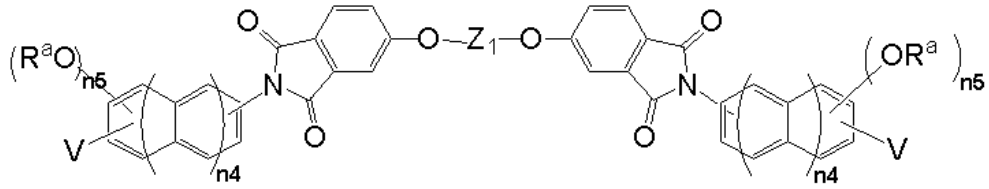
(A-1)



(A-2)

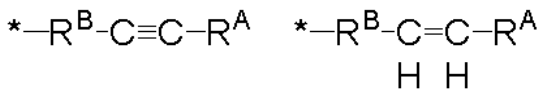
wherein W_1 and W_2 each independently represent a benzene ring or a naphthalene ring, and hydrogen atoms in the benzene ring and the naphthalene ring are optionally substituted with a hydrocarbon group having 1 to 6 carbon atoms; R^a represents a hydrogen atom or an organic group represented by the following general formula (2), and satisfies a relationship $e+f=1$ and $0.1 \leq f \leq 0.9$, wherein “e” represents the proportion of the hydrogen

atom and “f” represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; Y is a group represented by the following general formula (3); n_1 is 0 or 1; n_2 is 1 or 2; and V independently represents a hydrogen atom or a connection portion,



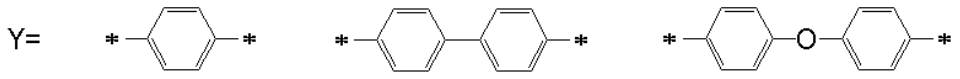
(A-3)

wherein Z_1 is a group represented by the following general formula (4), and R^a represents a hydrogen atom or an organic group represented by the following general formula (2) and satisfies a relationship e+f=1 and $0.1 \leq f \leq 0.9$, wherein “e” represents the proportion of the hydrogen atom and “f” represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; n_4 is 0 or 1, n_5 is 1 or 2, and V independently represents a hydrogen atom or a connection portion,



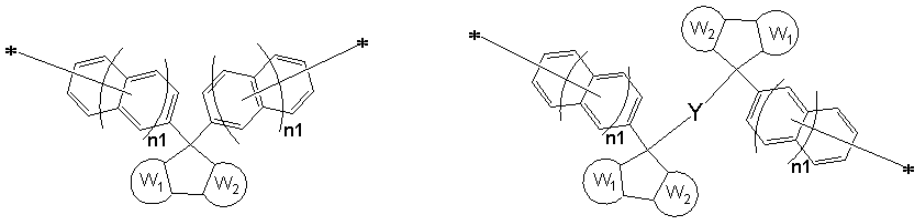
(2)

wherein * represents a site bonded with the oxygen atom, R^B represents a divalent organic group having 1 to 10 carbon atoms, and R^A represents a hydrogen atom or a monovalent organic group having 1 to 10 carbon atoms,

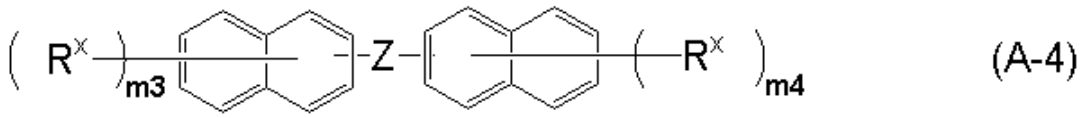


(3)

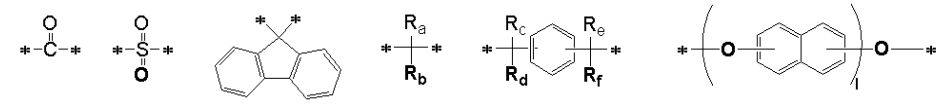
wherein * represents a bonding arm,

Z_1=  (4)

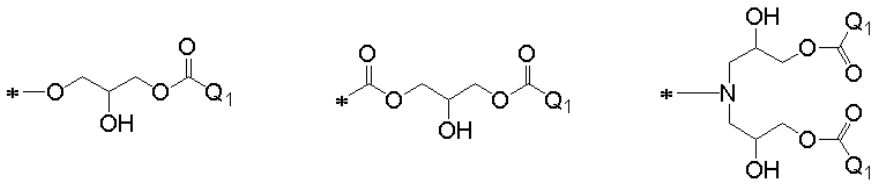
wherein W_1, W_2, Y, and n_1 are as defined above,

 (A-4)

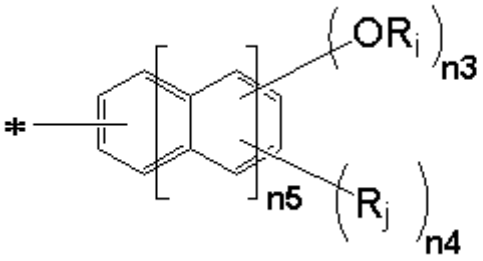
wherein m_3 and m_4 represent 1 or 2; Z represents either a single bond or the structure represented by the following general formula (5); and R^X is any one of the structures represented by the following general formula (6),

Z=  (5)

wherein * represents a bonding arm; l represents an integer of 0 to 3; R_a to R_f each independently represent a hydrogen atom or an optionally fluorine-substituted alkyl group having 1 to 10 carbon atoms, an optionally fluorine-substituted phenyl group, or an optionally fluorine-substituted phenylethyl group, and R_a and R_b may be bonded to each other to form a cyclic compound,

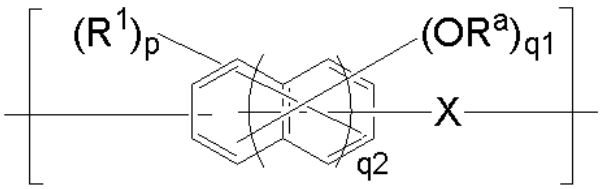
R^X=  (6)

wherein * represents a site bonded with the aromatic ring; Q_1 is a linear saturated hydrocarbon group having 1 to 30 carbon atoms, or the structure represented by the following general formula (7),



(7)

wherein * represents a site bonded with the carbonyl group; R_i represents a hydrogen atom or the organic group represented by the general formula (2), and satisfies a relationship e+f=1 and 0.1≤f≤0.9, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R_i; R_j represents a linear or branched hydrocarbon group having 1 to 10 carbon atoms, a halogen atom, a nitro group, an amino group, a nitrile group, an alkoxycarbonyl group having 1 to 10 carbon atoms, or an alkanoyloxy group having 1 to 10 carbon atoms; n_3 and n_4 are each an integer of 0 to 7 that represents the number of substituents on the aromatic ring, provided that n_3 + n_4 is 0 or more and 7 or less; and n_5 represents 0 to 2,



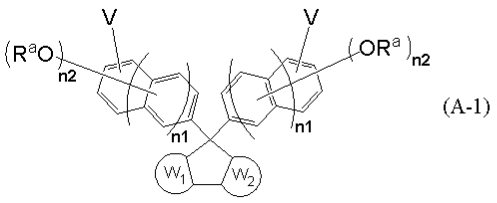
(A-5)

wherein R^1 represents a saturated monovalent organic group having 1 to 30 carbon atoms or an unsaturated monovalent organic group having 2 to 30 carbon atoms; X is a divalent organic group having 1 to 30 carbon atoms; and R^a represents a hydrogen atom or the organic group represented by the general formula (2), and satisfies a relationship e+f=1 and 0.1≤f≤0.9, wherein "e" represents

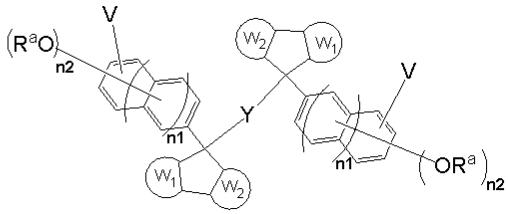
the proportion of the hydrogen atom and “f” represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; p is an integer of 0 to 5; q_1 is an integer of 1 to 6; $p+q_1$ is an integer of 1 or more and 6 or less; and q_2 is 0.

[Claim 12] The patterning process according to claim 10 or 11, wherein, in the step (I-1) or (II-1), in addition to the peripheral edge on the surface side of the substrate, the composition for forming a protection film is applied also to a peripheral edge on the backside of the substrate, thereby forming the protection film also on the peripheral edge on the backside of the substrate in the step (I-2) or (II-2).

[Claim 13] A composition for forming a protection film to be used for forming a protection film on a peripheral edge of a substrate, comprising:
an aromatic ring-containing resin (A) having at least one of the constituent units represented by the following general formulae (A-1), (A-2), (A-3), (A-4), and (A-5): and
a solvent,



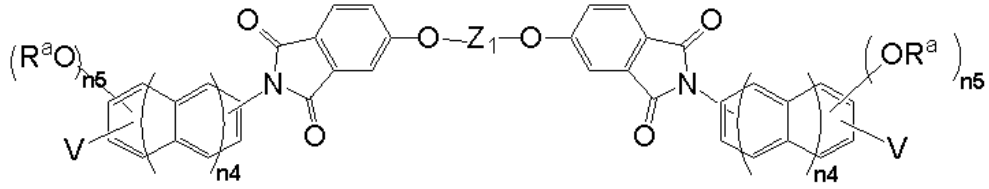
(A-1)



(A-2)

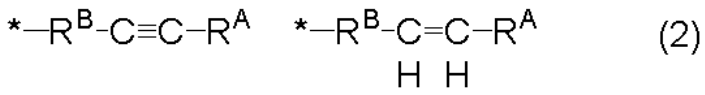
wherein W_1 and W_2 each independently represent a benzene ring or a naphthalene ring, and hydrogen atoms in the benzene ring and the naphthalene ring are optionally substituted with a hydrocarbon group having 1 to 6

carbon atoms; R^a represents a hydrogen atom or an organic group represented by the following general formula (2), and satisfies a relationship e+f=1 and $0.1 \leq f \leq 0.9$, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; Y is a group represented by the following general formula (3); n_1 is 0 or 1; n_2 is 1 or 2; and V independently represents a hydrogen atom or a connection portion,



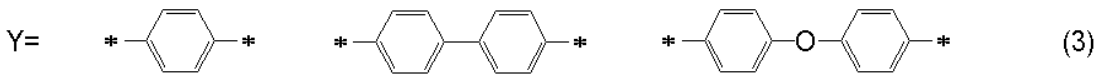
(A-3)

wherein Z_1 is a group represented by the following general formula (4), and R^a represents a hydrogen atom or an organic group represented by the following general formula (2) and satisfies a relationship e+f=1 and $0.1 \leq f \leq 0.9$, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; n_4 is 0 or 1, n_5 is 1 or 2, and V independently represents a hydrogen atom or a connection portion,



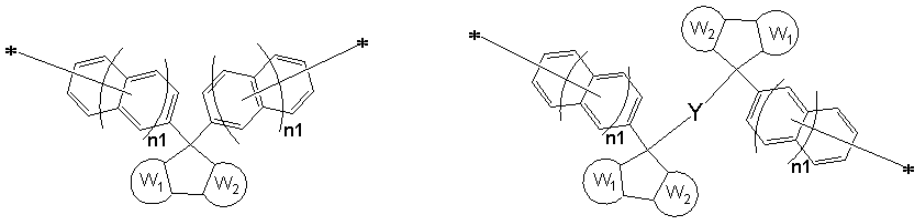
(2)

wherein * represents a site bonded with the oxygen atom, R^B represents a divalent organic group having 1 to 10 carbon atoms, and R^A represents a hydrogen atom or a monovalent organic group having 1 to 10 carbon atoms,

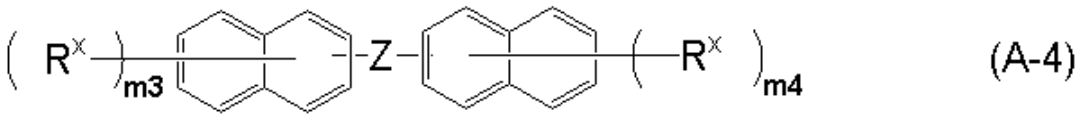


(3)

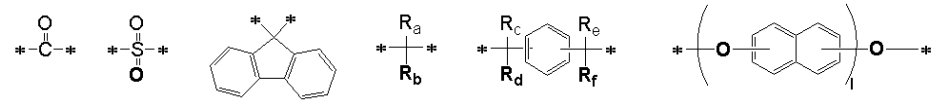
wherein * represents a bonding arm,

Z_1=  (4)

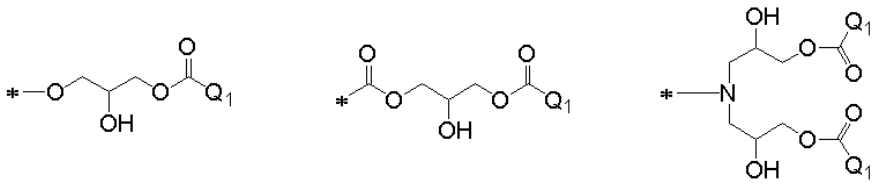
wherein W_1, W_2, Y, and n_1 are as defined above,

 (A-4)

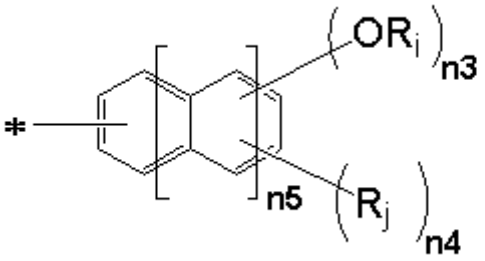
wherein m_3 and m_4 represent 1 or 2; Z represents either a single bond or the structure represented by the following general formula (5); and R^X is any one of the structures represented by the following general formula (6),

Z=  (5)

wherein * represents a bonding arm; l represents an integer of 0 to 3; R_a to R_f each independently represent a hydrogen atom or an optionally fluorine-substituted alkyl group having 1 to 10 carbon atoms, an optionally fluorine-substituted phenyl group, or an optionally fluorine-substituted phenylethyl group, and R_a and R_b may be bonded to each other to form a cyclic compound,

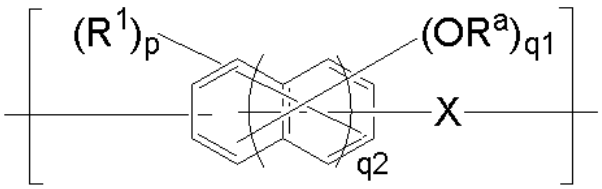
R^X=  (6)

wherein * represents a site bonded with the aromatic ring; Q_1 is a linear saturated hydrocarbon group having 1 to 30 carbon atoms, or the structure represented by the following general formula (7),



(7)

wherein * represents a site bonded with the carbonyl group; R_i represents a hydrogen atom or the organic group represented by the general formula (2), and satisfies a relationship e+f=1 and 0.1≤f≤0.9, wherein "e" represents the proportion of the hydrogen atom and "f" represents the proportion of the organic group represented by the general formula (2) among the structures constituting R_i; R_j represents a linear or branched hydrocarbon group having 1 to 10 carbon atoms, a halogen atom, a nitro group, an amino group, a nitrile group, an alkoxycarbonyl group having 1 to 10 carbon atoms, or an alkanoyloxy group having 1 to 10 carbon atoms; n_3 and n_4 are each an integer of 0 to 7 that represents the number of substituents on the aromatic ring, provided that n_3 + n_4 is 0 or more and 7 or less; and n_5 represents 0 to 2,



(A-5)

wherein R^1 represents a saturated monovalent organic group having 1 to 30 carbon atoms or an unsaturated monovalent organic group having 2 to 30 carbon atoms; X is a divalent organic group having 1 to 30 carbon atoms; and R^a represents a hydrogen atom or the organic group represented by the general formula (2), and satisfies a relationship e+f=1 and 0.1≤f≤0.9, wherein "e" represents

the proportion of the hydrogen atom and “f” represents the proportion of the organic group represented by the general formula (2) among the structures constituting R^a; p is an integer of 0 to 5; q_1 is an integer of 1 to 6; $p+q_1$ is an integer of 1 or more and 6 or less; and q_2 is 0.