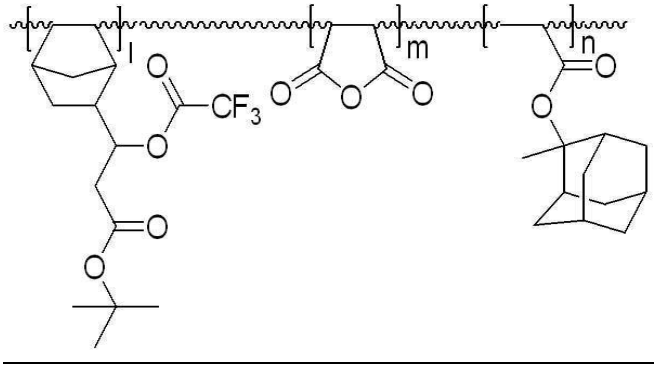
WHAT IS CLAIMED IS:

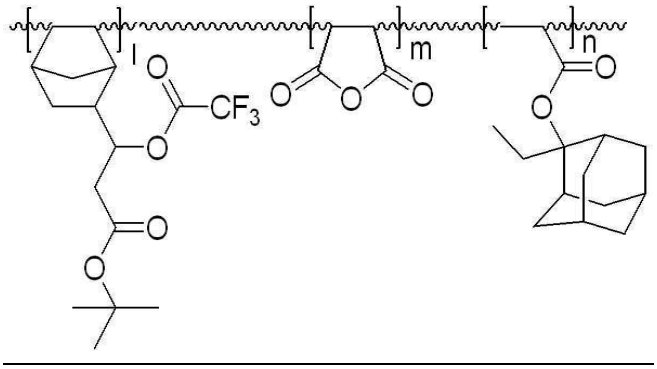
1. ~~A resist additive represented by Formula 1 below:~~A resist composition comprising a resist additive selected from the group consisting of compounds represented by Formulae 4 to 11 below, a resist base polymer, an acid generator, and a solvent, and

wherein the amount of the resist additive is in the range of 0.05 to 5% by weight based on the total weight of the resist composition:

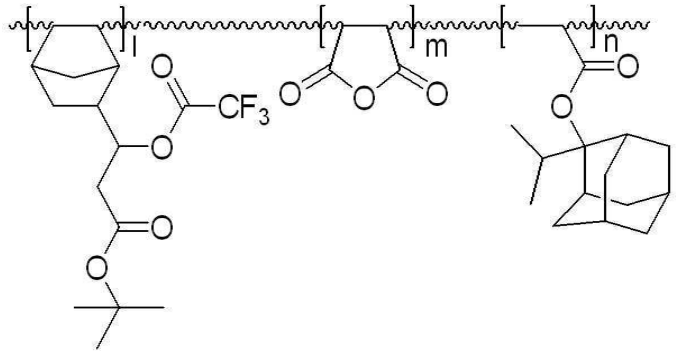
Formula 4



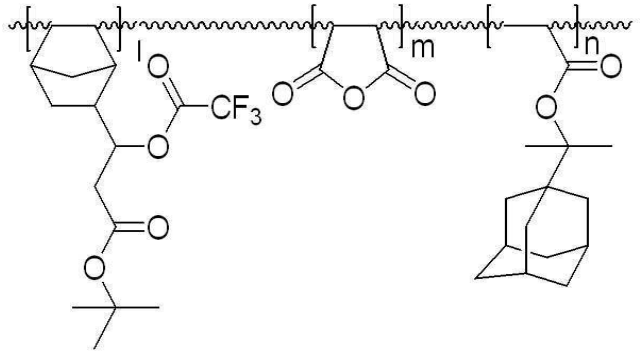
Formula 5



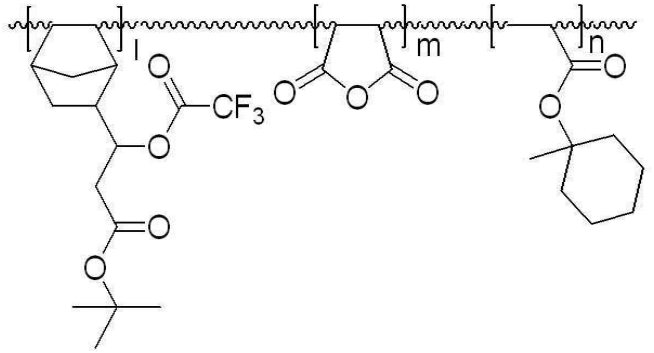
Formula 6



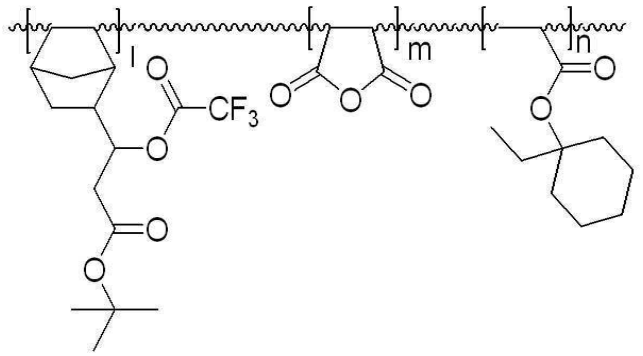
Formula 7



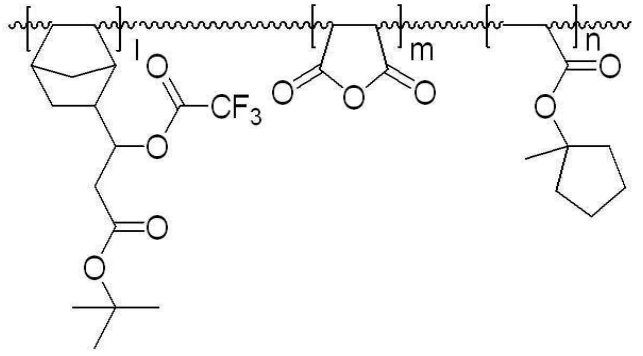
Formula 8



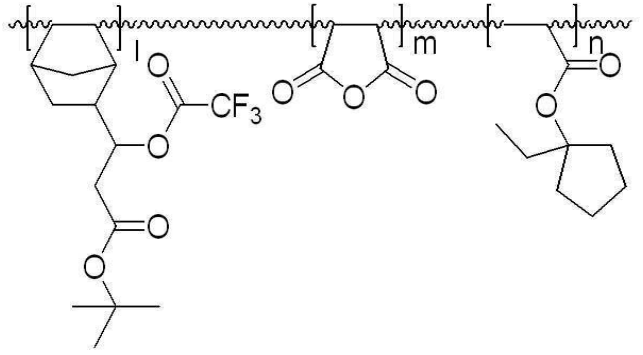
Formula 9



Formula 10

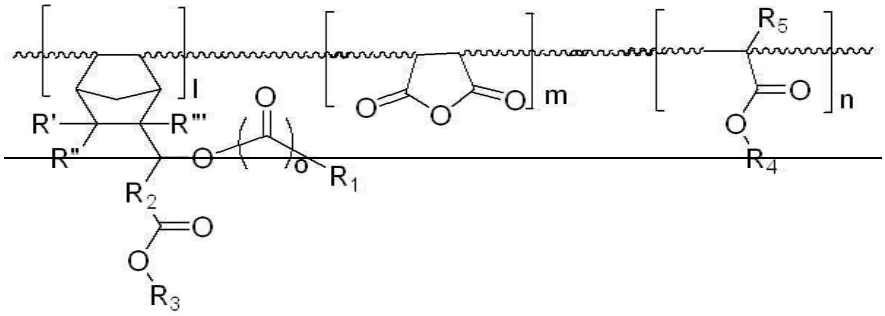


Formula 11



wherein l, m, and n are respectively numbers of the repeat units in a backbone, wherein l+m+n=1, $0<l/(l+m+n)<0.99$, $0<m/(l+m+n)<0.2$, and $0<n/(l+m+n)<0.99$.

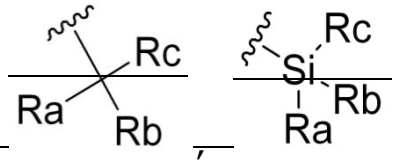
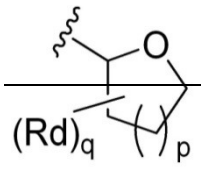
~~Formula 1~~



~~wherein R', R" and R"' are each independently selected from the group consisting of a hydrogen atom, a C1-C4 alkyl group, a halogen group, and a C1-C4 haloalkyl group in which one hydrogen atom is substituted with a halogen group,~~

~~R_1 is a hydrophobic group selected from the group consisting of a C1-C20 haloalkyl group, an organic silicon group, and a C3-C20 hydrocarbon group, wherein if R_1 is an organic silicon group, o is 0, and if R_1 is a C1-C20 haloalkyl group or C3-C20 hydrocarbon group, o is 1,~~

~~R_2 is selected from the group consisting of a C1-C20 alkanediyl group, a C2-C20 alkenediyl group, a C1-C20 heteroalkanediyl group, a C2-C20 heteroalkenediyl group, a C3-C30 cycloalkanediyl group, a C3-C30 cycloalkenediyl group, a C2-C30 heterocycloalkanediyl group, and a C3-C30 heterocycloalkenediyl group,~~

~~R_3 and R_4 are each independently an acid labile group selected from the group consisting of~~  ~~and~~  ~~, wherein R_a, R_b, R_c and R_d are each independently~~

selected from the group consisting of a C1-C20 alkyl group, a C3-C30 cycloalkyl group, a (C1-C10 alkyl)cycloalkyl group, a hydroxyalkyl group, a C1-C20 alkoxy group, a (C1-C10 alkoxy)alkyl group, an acetyl group, an acetylalkyl group, a carboxyl group, a (C1-C10 alkyl)carboxyl group, a (C3-C18 cycloalkyl)carboxyl group, and a C3-C30 heterocycloalkyl group or are fused together between adjacent groups to form a C3-C30 saturated or unsaturated hydrocarbon ring or a C2-C30 heterocyclic group, p is an integer of 0 to 3, and q is an integer of 0 to 10,

R_5 is a hydrogen atom or a C1-C8 alkyl group,

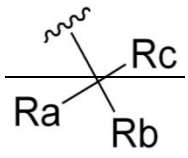
l, m, and n are respectively numbers of the repeat units in a backbone, wherein l+m+n=1, 0<l/(l+m+n)<0.99, 0<m/(l+m+n)¡Â0.20, and 0<n/(l+m+n)<0.99, and

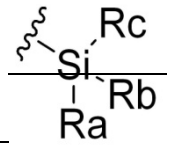
o is an integer of 0 or 1.

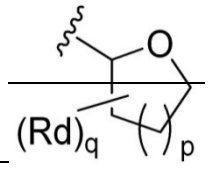
2. The resist additive of claim 1, wherein R_1 is selected from the group consisting of a C1-C10 fluoroalkyl group, a silyl group, a C1-C10 alkylsilyl group, a C3-C10 linear or branched alkyl group, a C3-C14 monocyclic cycloalkyl group, a C8-C18 dicyclic cycloalkyl group, a C10-C30 tricyclic cycloalkyl group, and a C10-C30 tetracyclic cycloalkyl group.

3. The resist additive of claim 1, wherein R_1 is selected from the group consisting of a t-butyl group, a trifluoromethyl group, a trimethylsilyl group, a di(trifluoromethyl)isopropyl group, a pentafluoroethyl group, and a heptafluoropropyl group.

4. The resist additive of claim 1, wherein R_3 and R_4 are each independently selected from the group consisting of

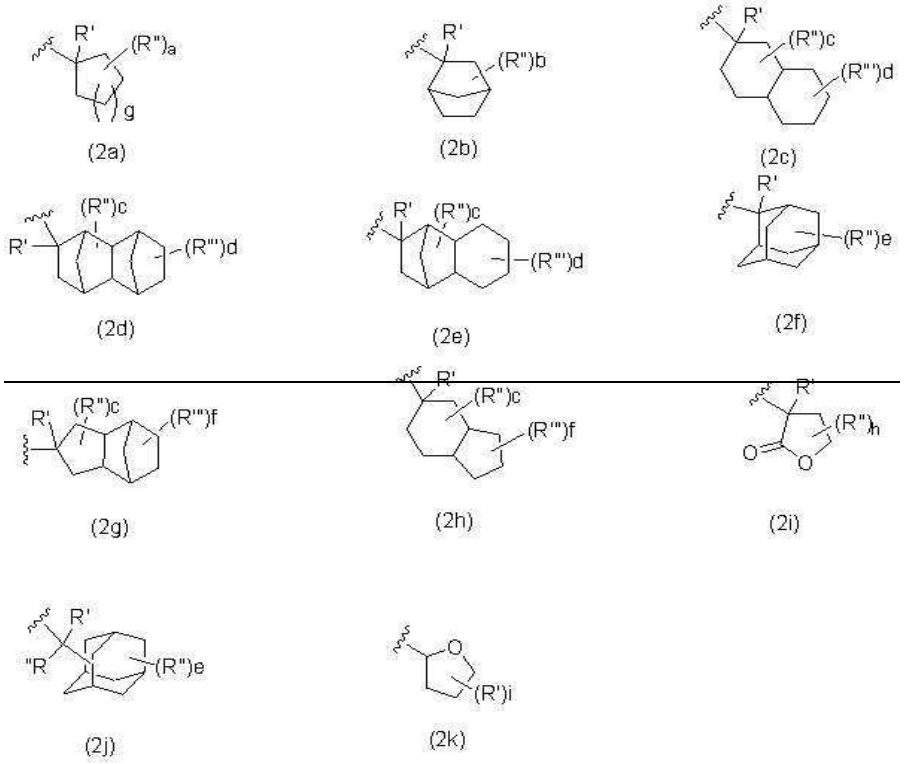


,


and


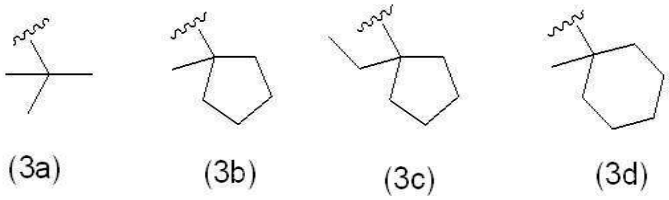
, wherein R_a, R_b, R_c and R_d are each independently selected from the group consisting of a C1-C10 alkyl group, a C3-C14 monocyclic cycloalkyl group, a C8-C20 dicyclic cycloalkyl group, a C10-C30 tricyclic cycloalkyl group, a C10-C30 tetracyclic cycloalkyl group, a (C1-C5 alkyl)cycloalkyl group, a hydroxyalkyl group, a C1-C10 alkoxy group, a (C1-C5 alkoxy)alkyl group, an acetyl group, an acetylalkyl group, a carboxyl group, a (C1-C5 alkyl)carboxyl group, and a (C3-C10 cycloalkyl)carboxyl group or are fused together between adjacent groups to form a C6-C18 saturated or unsaturated hydrocarbon ring or a C5-C18 heterocyclic group, p is an integer of 0 to 3, and q is an integer of 0 to 5.

5. The resist additive of claim 1, wherein R_3 and R_4 are each independently selected from the group consisting of a t-butyl group, a trimethylsilyl group, a hydroxy-2-ethyl group, a 1-methoxypropyl group, a 1-methoxy-1-methylethyl group, a 1-ethoxypropyl group, a 1-ethoxy-1-methylethyl group, a 1-methoxy-1-ethyl group, a 1-ethoxy-1-ethyl group, a t-butoxy-2-ethyl group, a 1-isobutoxy-1-ethyl group, and groups selected from the group consisting of Formulae 2a to 2k below:

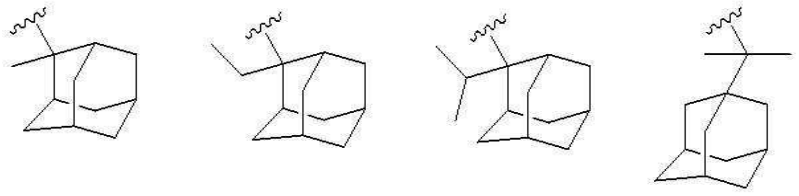


~~wherein R', R" and R"' are each independently a hydrogen atom or a C1-C10 alkyl group, a and e are each independently an integer of 0 to 15, b is an integer of 0 to 11, c and d are each independently an integer of 0 to 9, f is an integer of 0 to 7, g and i are each independently an integer of 0 to 6, h is an integer of 0 to 4, 0¡Âc+d¡Â17, and 0¡Âc+f¡Â15.~~

~~6. The resist additive of claim 1, wherein R_3 and R_4 are each independently selected from the group consisting of Formulae 3a to 3h below:~~



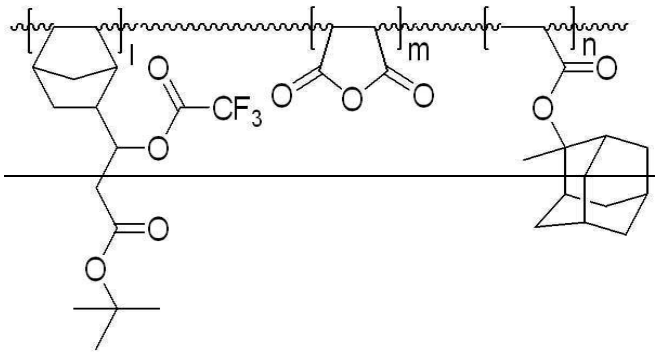
(3a) (3b) (3c) (3d)



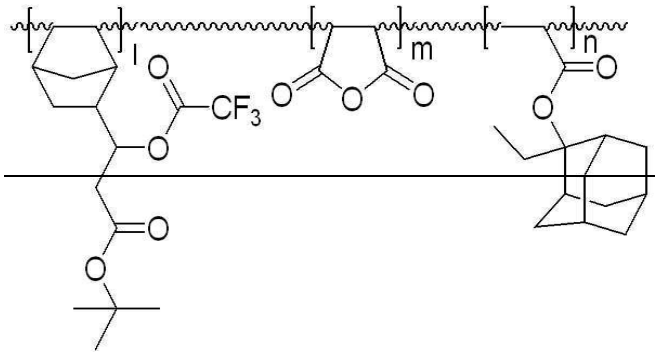
(3e) (3f) (3g) (3h)

~~7. The resist additive of claim 1, wherein the resist additive is selected from the group consisting of compounds represented by Formulae 4 to 11 below:~~

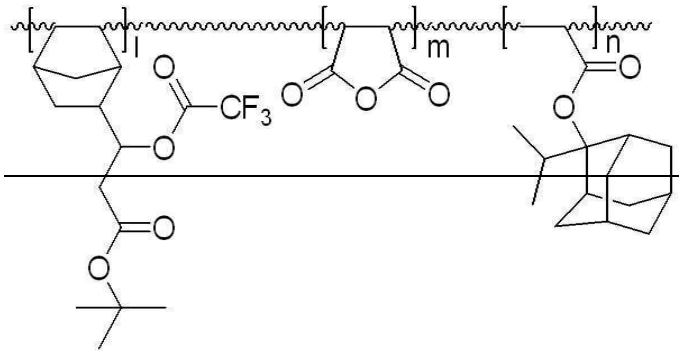
~~Formula 4~~



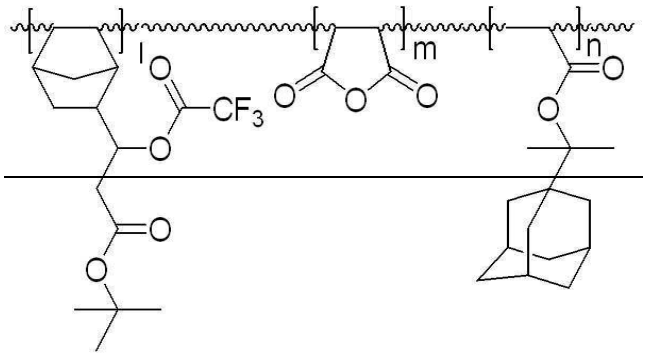
~~Formula 5~~



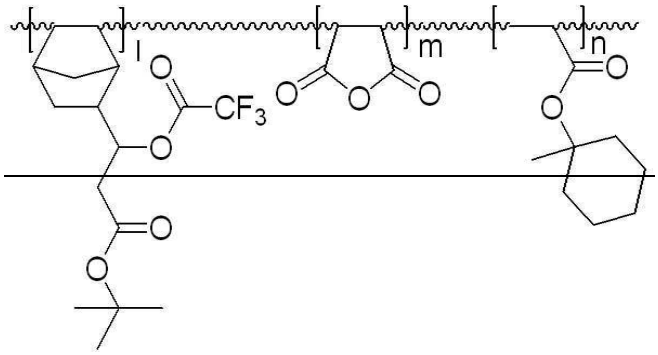
~~Formula 6~~



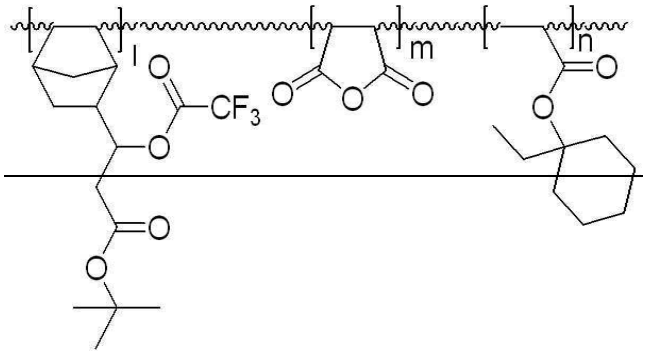
~~Formula 7~~



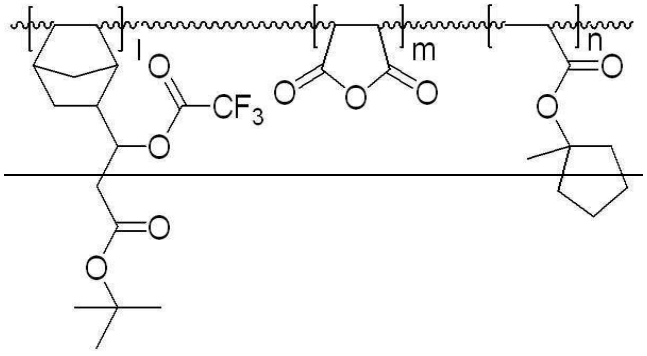
~~Formula 8~~



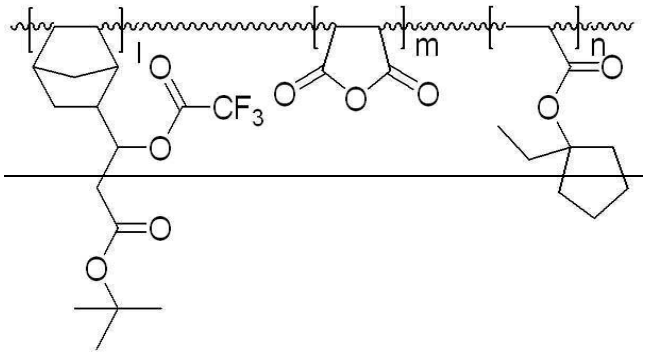
~~Formula 9~~



~~Formula 10~~



~~Formula 11~~



~~wherein l, m, and n are respectively numbers of the repeat units in a backbone, wherein l+m+n=1, 0<l/(l+m+n)<0.99, 0<m/(l+m+n)¡Â0.2, and 0<n/(l+m+n)<0.99.~~

~~8~~2. The resist composition~~additive~~ of claim 1, wherein a repeat unit m ~~of Formula 1~~ is comprised in a copolymer of the resist additive in an amount of 5 to 15 mol%.

~~9~~3. The resist composition~~additive~~ of claim 1, wherein a polystyrene equivalent weight average molecular weight of the resist additive measured using gel permeation chromatography is in the range of 1,000 to 20,000 g/mol.

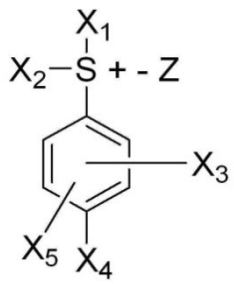
~~10~~4. The resist composition~~additive~~ of claim 1, wherein a weight average molecular weight/number average molecular weight ratio of the resist additive is in the range of 1 to 3.

~~11. A resist composition comprising a resist additive according to any one of claims 1 to 10, a resist base polymer, an acid generator, and a solvent.~~

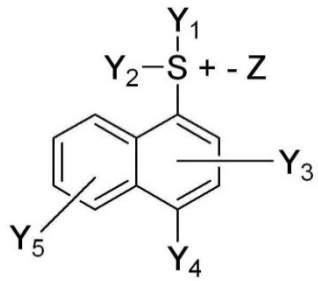
~~12. The resist composition of claim 11, wherein the amount of the resist additive is in the range of 0.05 to 5% by weight based on the total weight of the resist composition.~~

~~13~~5. The resist composition of claim 1~~11~~, wherein the acid generator comprises at least one compound selected from the group consisting of Formulae 14 and 15 below:

Formula 14



Formula 15

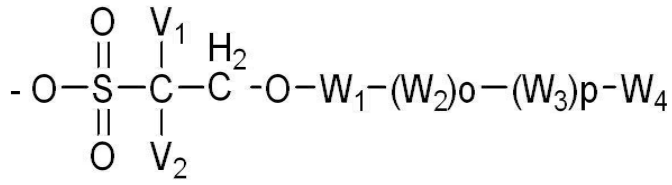


wherein X_1, X_2, Y_1, and Y_2 are each independently selected from the group consisting of a hydrogen atom, a C1–C10 alkyl group, an allyl group, a perfluoroalkyl group, a benzyl group, a C6–C30 aryl group, and any combination thereof, wherein X_1 and X_2 are fused to form a C3–C30 saturated or unsaturated hydrocarbon ring, and Y_1 and Y_2 are fused to form a C3–C30 saturated or unsaturated hydrocarbon ring,

X_3, X_4, X_5, Y_3, Y_4, and Y_5 are each independently selected from the group consisting of a hydrogen atom, a C1–C30 alkyl group, a halogen group, a C1–C30 alkoxy group, a C6–C30 aryl group, a thiophenoxy group, a C1–C30 thioalkoxy group, a C1–C20 alkoxycarbonylmethoxy group, and any combination thereof,

Z, which denotes an anion, is OSO_2CF_3, $OSO_2C_4F_9$, $OSO_2C_8F_{17}$, $N(CF_3)_2$, $N(C_2F_5)_2$, $N(C_4F_9)_2$, $C(CF_3)_3$, $C(C_2F_5)_3$, $C(C_4F_9)_3$, or a functional group represented by Formula 16 below:

Formula 16



wherein V_1 and V_2 are each independently a halogen atom,

W_1 is –(C=O)– or –(SO_2)–,

W_2 is a C1–C10 alkanediyl group,

W_3 is selected from the group consisting of a C3–C30 cycloalkyl group, a C6–C30 aryl group, a C7–C30 aralkyl group, a C6–C30 aryloxy group, a C6–C30 arylthio group, and a C5–C30 heterocyclic group,

W_4 is selected from the group consisting of a hydrogen atom, a halogen group, a C1–C10 alkyl group, a C1–C10 alkoxy group, a C1–C10 haloalkyl group, a C1–C10 alkylthio group, a C6–C30 aryl group, and any combination thereof,

o is an integer of 0 to 1, and

p is an integer of 0 to 2.

~~14~~6. The resist composition of claim 1~~11~~, wherein the amount of the acid generator is in the range of 0.3 to 10 parts by weight based on 100 parts by weight of solids of the resist composition.

~~15~~7. The resist composition of claim 1~~11~~, further comprising an additive selected from the group consisting of an alkali soluble quencher, an acid diffusion quencher, a surfactant, and any mixture thereof.

~~16~~8. A method of forming a resist pattern, the method comprising:

forming a resist film by coating the resist composition according to claim 1~~11~~ on a substrate;

heating the resist film, and exposing the resist film to light to form a predetermined pattern; and

developing the exposed pattern.

~~17~~9. The method of claim ~~16~~ 8 , wherein the exposing is performed using a light source selected from the group consisting of a KrF excimer laser, an ArF excimer laser, an extreme ultraviolet laser, an X-ray, and an electron beam.