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TITLE

**ACRYLIC MONOMER, POLYMER, AND CHEMICALLY AMPLIFIED
PHOTORESIST COMPOSITION**

BACKGROUND

1. Field of the Invention

The present invention relates to a semiconductor device, and more particularly, to an acrylic monomer, a polymer, and a chemically amplified photoresist composition, which may be used in manufacturing the semiconductor device.

2. Description of the Related Art

As a semiconductor device is high-integrated, there may arise a demand for forming an ultra-fine pattern having a size about 0.10 μm or less when fabricating a ultra large scale integration (ULSI) chip, and the like. In general, a photoresist composition used in forming the ultra-fine pattern may be comprised of a polymer, a Photo Acid Generator (PAG), and a solvent. Of these, the polymer may need to include a functional group having affinity for a developing solution, an adhesive force with a substrate, etching resistance, and an excellent resolution. As examples of the functional group capable of improving the affinity for the developing solution and adhesive force with the substrate, a hydroxy group, a lactone group, a carboxyl group, and the like may be given. Also, as examples of the functional group capable of improving the etching resistance, a norbornene derivative, an adamantane derivative, and the like may be given.

However, to improve the resolution, a structure of the polymer, that is, acid

mobility by the PAG may be more important than a particular functional group.

Performance of the polymer may be continuously improved. However, there is a need for a new polymer having an appropriate resolution and a composition including the new polymer.

SUMMARY

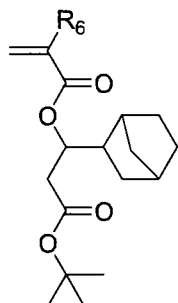
An aspect of the present invention provides an acrylic monomer, a polymer, and a chemically amplified photoresist composition, which may be used in forming a photoresist having less substrate-dependency and excellent transparency, and also being excellent in contrast, sensitivity, and developing properties.

An aspect of the present invention also provides an acrylic monomer, a polymer, and a chemically amplified photoresist composition, which may improve etching resistance of a photoresist.

According to an aspect of the present invention, there is provided an acrylic monomer having a t-butoxycarbonyl group (t-BOC group) at its distal end.

In this instance, the acrylic monomer may be represented as Chemical Formula (I),

[Chemical Formula (I)]

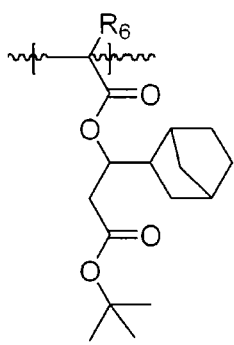


where R_6 denotes either hydrogen or a methyl group.

According to an aspect of the present invention, there is provided a polymer where a mixture including an acrylic monomer is polymerized, and the acrylic monomer may have a t-BOC group at its distal end.

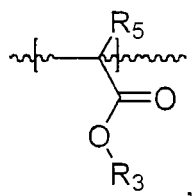
In this instance, wherein the polymer may include a recurring unit being represented as Chemical Formulas (II) and (III), respectively

[Chemical Formula (II)]



where R_6 denotes either hydrogen or a methyl group, and

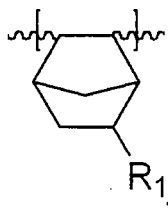
[Chemical Formula (III)]



where R_3 denotes either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including any one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group, and R_5 denotes either hydrogen or a methyl group.

Also, the polymer may further include a recurring unit being represented as Chemical Formula (IV),

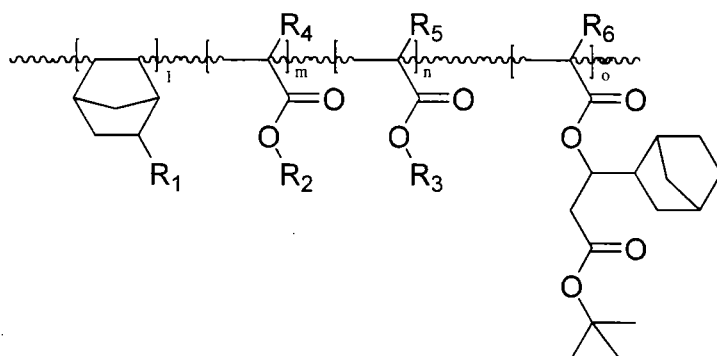
[Chemical Formula (IV)]



where R_1 denotes either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group.

Also, the polymer may be represented as Chemical Formula (V),

[Chemical Formula (V)]



where R_1 , R_2 , and R_3 separately denote either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group, R_4 , R_5 and R_6 separately denote either hydrogen or a methyl group, and l , m , n and o respectively denote a numeral value indicating a recurring unit within a main chain, each numeral value satisfying $l + m + n + o = 1$, $0 \leq l / (l + m + n + o) < 0.4$, $0 < m / (l + m + n + o) < 0.6$, $0 \leq n / (l + m + n + o) < 0.6$, $0 < o / (l + m + n + o) < 0.4$.

Also, the polymer may have an average molecular weight in terms of

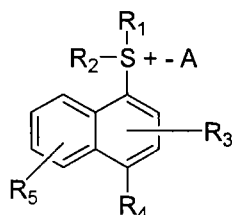
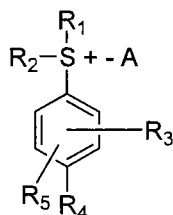
polystyrene of 2,000 to 1,000,000, and a molecular weight distribution of 1 to 5.

According to an aspect of the present invention, there is provided a chemically amplified photoresist composition, and the photoresist composition may include a polymer, a Photo Acid Generator (PAG), and a solvent, the polymer where a mixture including an acrylic monomer is polymerized. In this instance, the acrylic monomer may have a t-BOC group at its distal end.

Also, the polymer may be in a ratio of 3 to 20 parts by weight based on 100 parts by weight of a total amount of the photoresist composition.

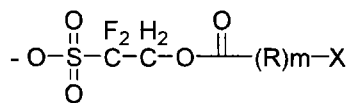
Also, the PAG may be at least one of compounds being represented as Chemical Formula (VI) and (VII), respectively

[Chemical Formula VI] and [Chemical Formula VII]



where R_1 and R_2 separately denote any one of an alkyl group, an allyl group, a perfluoroalkyl group, a benzyl group, and an aryl group, R_3 , R_4 and R_5 separately denote one of hydrogen atoms, an alkyl group, a halogen group, an alkoxy group, an aryl group, a thiopheneoxy group, a thioalkoxy group, and an alkoxycarbonylmethoxy group, and $-A$ denotes a compound represented as one of $^-\text{OSO}_2\text{CF}_3$, $^-\text{OSO}_2\text{C}_4\text{F}_9$, $^-\text{OSO}_2\text{C}_8\text{F}_{17}$, $^-\text{N}(\text{CF}_3)_2$, $^-\text{N}(\text{C}_2\text{F}_5)_2$, $^-\text{N}(\text{C}_4\text{F}_9)_2$, $^-\text{C}(\text{CF}_3)_3$, $^-\text{C}(\text{C}_2\text{F}_5)_3$, $^-\text{C}(\text{C}_4\text{F}_9)_3$, and Chemical Formula (VIII),

[Chemical Formula (VIII)]



where X denotes one of a monocyclic or polycyclic C₃ to C₃₀ hydrocarbon group, a benzyl group, a C₆ to C₂₀ aryl group, a C₁ to C₂₀ alkyl group, a C₁ to C₂₀ alkyl halide group, a C₁ to C₂₀ alkylsulfonyl group, a C₁ to C₂₀ alkoxy group, a C₁ to C₂₀ allyl group, and a C₁ to C₂₀ cyano group, at least one hydrogen atom of one of the monocyclic or polycyclic C₃ to C₃₀ hydrocarbon group, the benzyl group, the C₆ to C₂₀ aryl group, the C₁ to C₂₀ alkyl group, the C₁ to C₂₀ alkyl halide group, the C₁ to C₂₀ alkylsulfonyl group, the C₁ to C₂₀ alkoxy group, and the C₁ to C₂₀ allyl group is substituted with one of an ether group, an ester group, a carbonyl group, an acetal group, a nitril group, a cyano group, a hydroxyl group, a carboxyl group, and an aldehyde group, R denotes one of a C₁ to C₁₀ alkyl group, a C₁ to C₁₀ alkoxy group, a nitrogen atom, a sulfur atom, a fluorine atom, and an oxygen atom, and m denotes an integer of 0 to 2.

Also, the PAG may be in a ratio of 0.3 to 15 parts by weight based on 100 parts by weight of an entire solid of the photoresist composition.

Additional aspects, features, and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be apparent from the description, or may be learned by practice of the invention.

EFFECT

According to exemplary embodiments, there is provided a photoresist formed using a chemically amplified photoresist composition including a polymer where an acrylic monomer used as a raw material is polymerized. In this instance, the

photoresist may have less substrate-dependency and excellent transparency, and may be excellent in contrast, sensitivity, resolution, and developing properties. Also, the photoresist may have etching resistance. Through these, a semiconductor device having an ultra-fine pattern may be manufactured.

BRIEF DESCRIPTION OF THE DRAWINGS

These and/or other aspects, features, and advantages of the invention will become apparent and more readily appreciated from the following description of exemplary embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a graph illustrating a ^1H -NMR spectrum of a monomer obtained by Synthesis Example 1 according to exemplary embodiments;

FIG. 2 is a graph illustrating a ^1H -NMR spectrum of a monomer obtained by Synthesis Example 2 according to exemplary embodiments;

FIG. 3 is a graph illustrating a ^1H -NMR spectrum of a polymer obtained by Synthesis Example 4 according to exemplary embodiments;

FIG. 4 is a graph illustrating a Gel Permeation Chromatography (GPC) data of a polymer obtained by Synthesis Example 4 according to exemplary embodiments;

FIG. 5 is a graph illustrating a ^1H -NMR spectrum of a polymer obtained by Synthesis Example 5 according to exemplary embodiments;

FIG. 6 is a graph illustrating a GPC data of a polymer obtained by Synthesis Example 5 according to exemplary embodiments;

FIG. 7 is a graph illustrating a ^1H -NMR spectrum of a polymer obtained by Synthesis Example 6 according to exemplary embodiments;

FIG. 8 is a graph illustrating a GPC data of a polymer obtained by Synthesis Example 6 according to exemplary embodiments;

FIG. 9 is a graph illustrating a ^1H -NMR spectrum of a polymer obtained by Synthesis Example 7 according to exemplary embodiments;

FIG. 10 is a graph illustrating a GPC data of a polymer obtained by Synthesis Example 7 according to exemplary embodiments;

FIG. 11 is a graph illustrating a ^1H -NMR spectrum of a polymer obtained by Synthesis Example 8 according to exemplary embodiments; and

FIG. 12 is a graph illustrating a GPC data of a polymer obtained by Synthesis Example 8 according to exemplary embodiments.

DETAILED DESCRIPTION

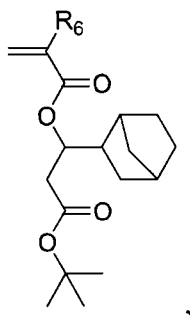
Hereinafter, an acrylic monomer, a polymer, and a chemically amplified photoresist composition according to exemplary embodiments will be described in detail.

Acrylic monomer

The acrylic monomer according to exemplary embodiments may be used as a raw material of the polymer, and may have a t-butoxycarbonyl group (t-BOC group) at its distal end.

The acrylic monomer is not particularly limited, however, for example, a compound in which (metha) acrylate is introduced into a norbornene derivative or a norbornane derivative may be used as the acrylic monomer. In this instance, the compound may improve etching resistance of a photoresist. The acrylic monomer may be a compound represented as

[Chemical Formula (I)]



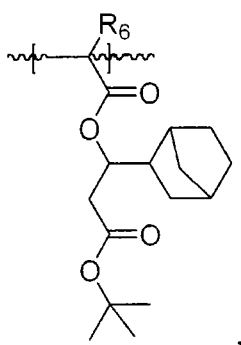
where R₆ denotes either hydrogen or a methyl group.

Polymer

The polymer according to exemplary embodiments may be a compound where a mixture including an acrylic monomer is polymerized, and the acrylic monomer may have a t-BOC group at its distal end.

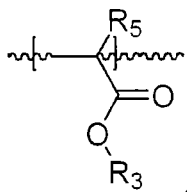
The polymer is not particularly limited, however, for example, the polymer may include a recurring unit being represented as the following Chemical Formulas (II) and (III), respectively,

[Chemical Formula (II)]



where R₆ denotes either hydrogen or a methyl group, and

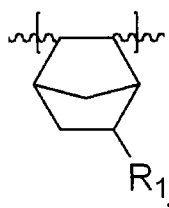
[Chemical Formula (III)]



where R_3 denotes either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including any one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group, and R_5 denotes either hydrogen or a methyl group.

Also, the polymer may further include a recurring unit being represented as

[Chemical Formula (IV)]



where R_1 denotes either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group.

The recurring unit represented as Chemical Formula (II) may be a recurring unit by the above described acrylic monomer. Using the recurring unit represented as Chemical Formula (II), a residual film ratio required in an ArF-liquid immersion exposure of a photoresist may be reinforced. When a light is irradiated, a t-BOC group, that is, an acid-sensitive group may be separated. The separated t-BOC group may improve mobility of an acid. Through this, a resolution of the photoresist and a contrast may be improved, thereby obtaining a photoresist pattern profile excellent in

perpendicularity.

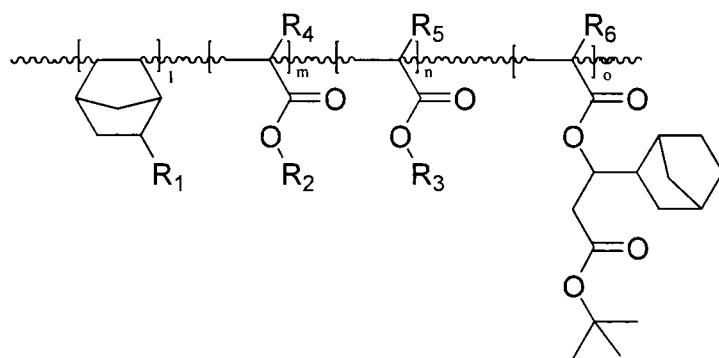
An acid-sensitive functional group may be introduced into the recurring unit represented as Chemical Formula (III). A moiety for improving an adhesive force with a substrate of the photoresist may be introduced into the recurring unit represented as Chemical Formula (III). As a reinforcing agent for the adhesive force with the substrate, for example, a lactone-containing acrylic monomer may be used. Also, a bulky hydrocarbon compound for increasing etching resistance of the photoresist may be introduced while using the acid-sensitive functional group and a lactone-containing functional group for reinforcing the adhesive force with the substrate. A number of the recurring units represented as Chemical Formula (III) may be at least two, and the at least two recurring units represented as Chemical Formula (III) may be different from each other. In this case, various functional groups, the moiety, the bulky hydrocarbon compound, and the like may be introduced, and each of the polymer and the chemically amplified photoresist composition may be used in various types.

The recurring unit represented as Chemical Formula (IV) may be a recurring unit by a norbornene derivative. Since a norbornene functional group of the norbornene derivative is incited to have a spiral structure obtained such that the polymer is transformed, a poor solubility with a solvent of an existing methacrylic copolymer may be significantly improved. When acryl is solely copolymerized, a molecular weight of the polymer may be difficult to be adjusted, and the polymer having a low molecular weight may be difficult to be synthesized. However, when introducing the norbornene derivative into a polymerization reaction, a degree in which the acrylic is polymerized may be adjusted to thereby fabricate the polymer having the low molecular weight. That is, the norbornene derivative may serve to adjust the molecular weight of

the polymer. Also, the norbornene derivative may improve the etching resistance of the photoresist.

The polymer, for example, may be represented as

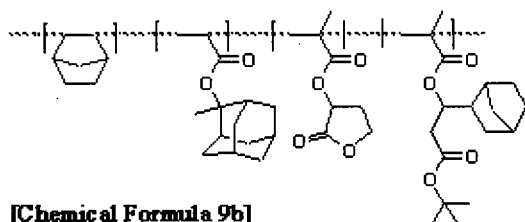
[Chemical Formula (V)]



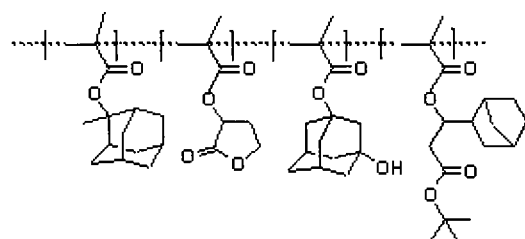
where R_1 , R_2 , and R_3 separately denote either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group, R_4 , R_5 and R_6 separately denote either hydrogen group or a methyl group, and l , m , n and o respectively denote a numeral value indicating a recurring unit within a main chain, each numeral value satisfying $l + m + n + o = 1$, $0 \leq l / (l + m + n + o) < 0.4$, $0 < m / (l + m + n + o) < 0.6$, $0 \leq n / (l + m + n + o) < 0.6$, $0 < o / (l + m + n + o) < 0.4$. That is, l may be in a ratio of 10% to 40% by weight based on an entire monomer for polymerizing the polymer.

As specific examples of the polymer, compounds represented as the following Chemical Formulas 9a to 9n, however, the present invention is not limited thereto.

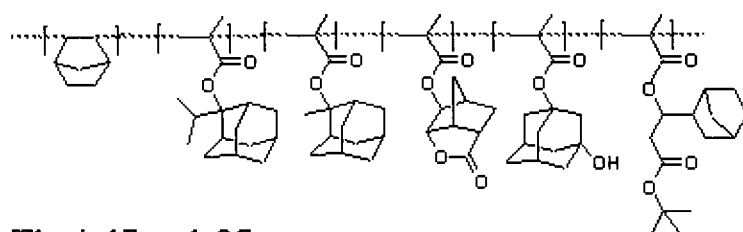
[Chemical Formula 9a]



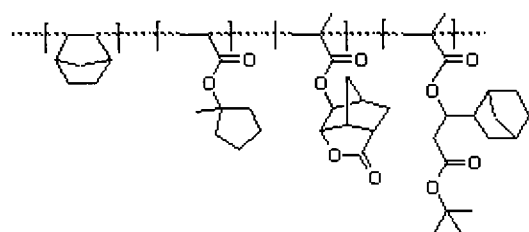
[Chemical Formula 9b]



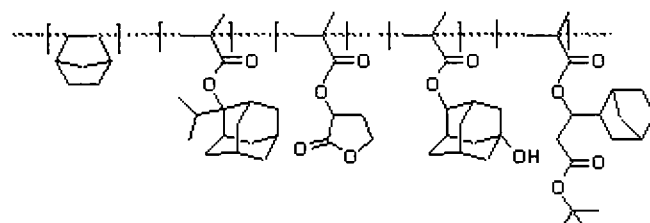
[Chemical Formula 9c]



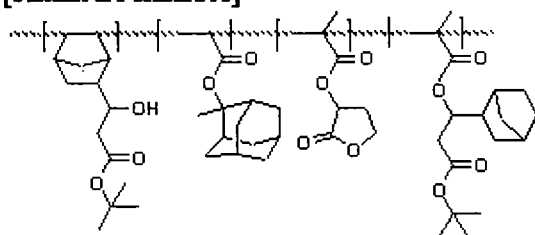
[Chemical Formula 9d]



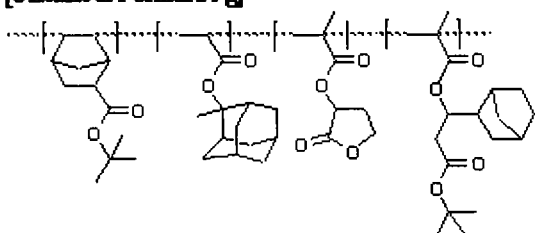
[Chemical Formula 9e]



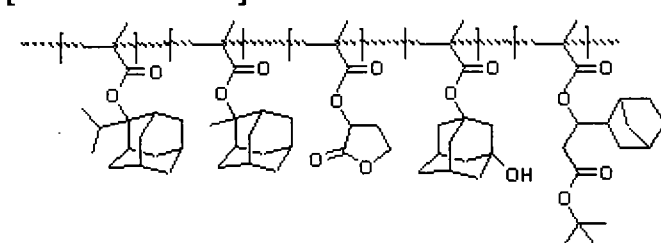
[Chemical Formula 9f]



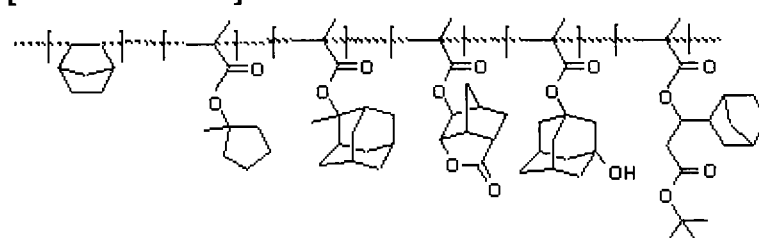
[Chemical Formula 9g]



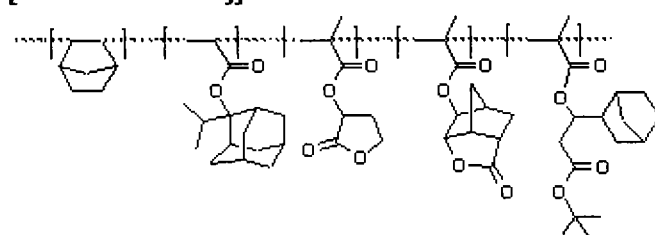
[Chemical Formula 9h]



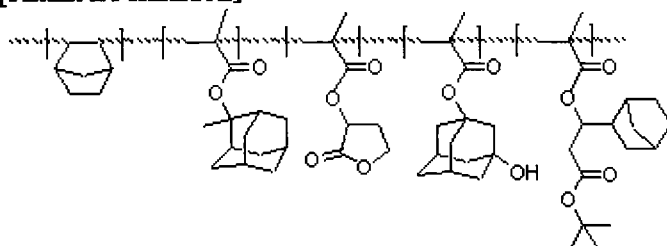
[Chemical Formula 9i]



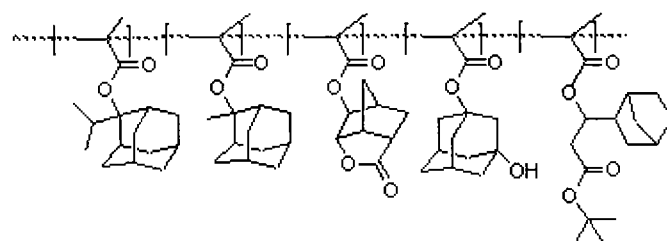
[Chemical Formula 9j]



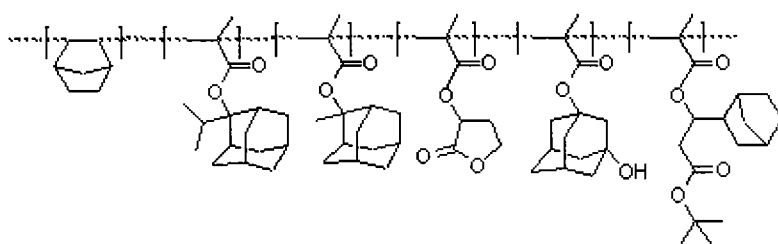
[Chemical Formula 9k]



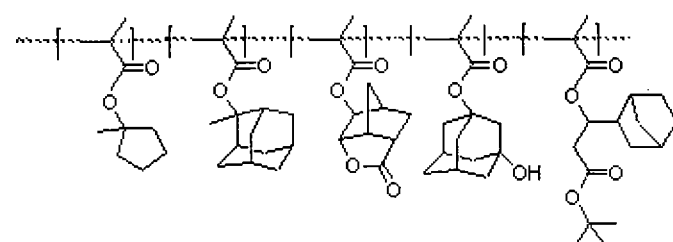
[Chemical Formula 9l]



[Chemical Formula 9m]



[Chemical Formula 9n]



The polymer may be insoluble or scarcely soluble in an alkali aqueous solution, however, may be soluble in the alkali aqueous solution, as necessary. However, the polymer may or may not have the acid-sensitive functional group at its side-chain, as necessary.

Depending on a change in a type and content of the monomer for synthesizing

the polymer, solubility of the polymer may be increased or reduced. In general, as a hydrophobic group of the polymer increases, the solubility with respect to the alkali aqueous solution may be reduced. In this manner, the photoresist, which is manufactured using the polymer obtained by adjusting the type and content of the monomer, may be excellent in adhesive properties with the substrate, substrate-independency, sensitivity, and resolution.

The polymer may be a bicopolymer or a multicopolymer. The bicopolymer or the multicopolymer may be, for example, a block copolymer, a random copolymer, or a graft copolymer. The polymer may be polymerized in a typical scheme, however, may preferably be polymerized in a radical polymerization scheme. As examples of an initiator of a radical polymerization used when the radical polymerization scheme is carried out, azobisisobutyronitrile (AIBN), benzoyl peroxide (BPO), lauryl peroxide, azobisisocapronitrile, azobisisovaleronitrile, t-butyl hydro peroxide, and the like may be given, and may be used alone or in a combination of two or more. The polymer may be polymerized in a scheme such as bulk polymerization, solution polymerization, suspension polymerization, bulk suspension polymerization, emulsion polymerization, and the like. As examples of a polymerization solvent used when polymerizing the polymer, benzene, toluene, xylene, halogenated benzene, diethyl ether, tetrahydrofuran, esters, ethers, lactones, ketones, amides, alcohols, and the like may be given, and may be used alone or in a combination of two or more. A solvent may be used when polymerizing the polymer. A polymerization temperature when polymerizing the polymer may be appropriately selected depending on a type of the solvent. After the polymerization of the polymer is completed, a non-reacted monomer and by-product remaining in a reaction mixture may be preferably removed by a precipitation method

using the solvent.

A molecular weight of the polymer and a dispersion of the molecular weight of the polymer may be appropriately adjusted by changing a used amount of the initiator of the polymerization and a reaction time. The weight-average molecular weight (M_w) of the polymer measured by a Gel Permeation Chromatography (GPC) in terms of polystyrene may be in a range of about 2,000 to 1,000,000, and may be preferably in a range of about 3,000 to 50,000 based on sensitivity, developing property, coating property, heat resistance, and the like. When the weight-average molecular weight of the polymer in terms of polystyrene is less than 2,000, a resist pattern may be easily broken and deformed, and when the weight-average molecular weight of the polymer in terms of polystyrene is more than 1,000,000, a resolution of the resist pattern may be deteriorated. A molecular weight distribution of the polymer may be 1 to 5, and preferably 1 to 3.

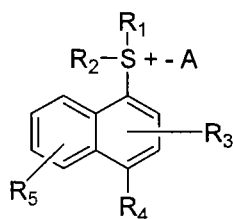
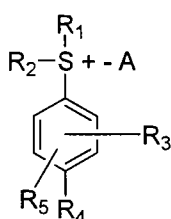
Chemically amplified photoresist composition

The chemically amplified photoresist composition according to exemplary embodiments includes a polymer where a mixture including an acrylic monomer is polymerized, a Photo Acid Generator (PAG), and a solvent. In this instance, the acrylic monomer may have a t-BOC group at its distal end. Also, the chemically amplified photoresist composition may further include other additives, as necessary. The other additives may not be particularly limited, however, for example, a surfactant, water-soluble alcohols, basic additives, and the like may be used alone, or in a combination of two or more. Here, the polymer included in the chemically amplified photoresist composition according to exemplary embodiments may be the same as the above described polymer, and thus repeated descriptions thereof will be omitted.

A content of the polymer may be 3 to 20 parts by weight based on 100 parts by weight of the entire chemically amplified photoresist composition. In this instance, when the content of the polymer is less than 3 parts by weight, a thickness of a resist film may be significantly reduced, and thus a desired thickness of the resist pattern may be difficult to be obtained, and when the content of the polymer exceeds 20 parts by weight, the thickness of the resist film may be significantly increased.

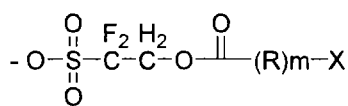
For example, at least one of compounds represented as the following Chemical Formulas (VI) and (VII) may be used as the PAG, however, the PAG is not particularly limited thereto.

[Chemical Formula VI] and [Chemical Formula VII]



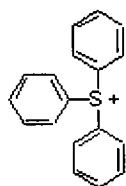
where R_1 and R_2 separately denote any one of an alkyl group, an allyl group, a perfluoroalkyl group, a benzyl group, and an aryl group, R_3 , R_4 and R_5 separately denote one of hydrogen atoms, an alkyl group, a halogen group, an alkoxy group, an aryl group, a thiopheneoxy group, a thioalkoxy group, and an alkoxycarbonylmethoxy group, and $-A$ denotes a compound represented as one of $^{-}\text{OSO}_2\text{CF}_3$, $^{-}\text{OSO}_2\text{C}_4\text{F}_9$, $^{-}\text{OSO}_2\text{C}_8\text{F}_{17}$, $^{-}\text{N}(\text{CF}_3)_2$, $^{-}\text{N}(\text{C}_2\text{F}_5)_2$, $^{-}\text{N}(\text{C}_4\text{F}_9)_2$, $^{-}\text{C}(\text{CF}_3)_3$, $^{-}\text{C}(\text{C}_2\text{F}_5)_3$, $^{-}\text{C}(\text{C}_4\text{F}_9)_3$, and the following Chemical Formula (VIII).

[Chemical Formula (VIII)]

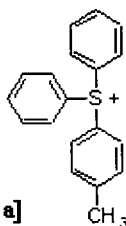


where X denotes one of a monocyclic or polycyclic C₃ to C₃₀ hydrocarbon group, a benzyl group, a C₆ to C₂₀ aryl group, a C₁ to C₂₀ alkyl group, a C₁ to C₂₀ alkyl halide group, a C₁ to C₂₀ alkylsulfonyl group, a C₁ to C₂₀ alkoxy group, a C₁ to C₂₀ allyl group, and a C₁ to C₂₀ cyano group, at least one hydrogen atom of one of the monocyclic or polycyclic C₃ to C₃₀ hydrocarbon group, the benzyl group, the C₆ to C₂₀ aryl group, the C₁ to C₂₀ alkyl group, the C₁ to C₂₀ alkyl halide group, the C₁ to C₂₀ alkylsulfonyl group, the C₁ to C₂₀ alkoxy group, and the C₁ to C₂₀ allyl group is substituted with one of an ether group, an ester group, a carbonyl group, an acetal group, a nitril group, a cyano group, a hydroxyl group, a carboxyl group, and an aldehyde group, R denotes one of a C₁ to C₁₀ alkyl group, a C₁ to C₁₀ alkoxy group, a nitrogen atom, a sulfur atom, a fluorine atom, and an oxygen atom, and m denotes an integer of 0 to 2.

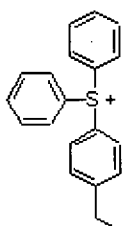
As examples of a cation of the compounds represented as Chemical Formulas (VI) and (VII), compounds represented as the following Chemical Formulas 10a to 10p may be given.



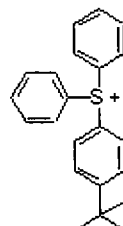
[Chemical Formula 10a]



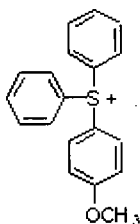
[Chemical Formula 10b]



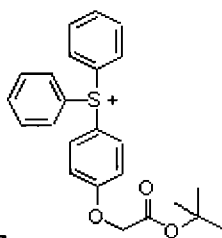
[Chemical Formula 10c]



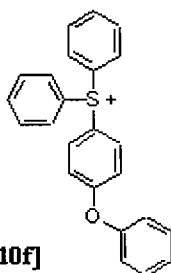
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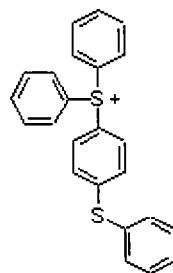
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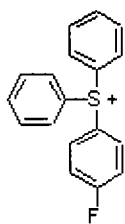
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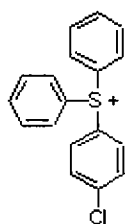
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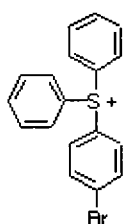
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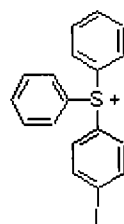
[Chemical Formula 10i]



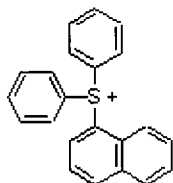
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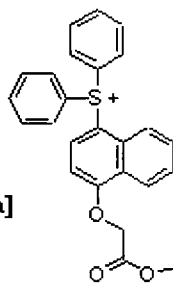
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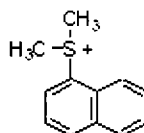
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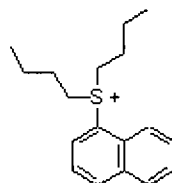
[Chemical Formula 10m]



[Chemical Formula 10n]

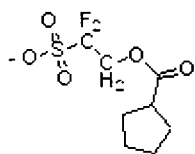


[Chemical Formula 10o]

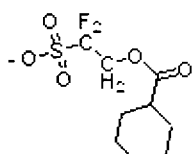


[Chemical Formula 10p]

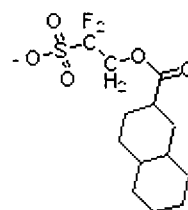
As examples of the compound represented as Chemical Formula (VIII), compounds represented as the following Chemical Formulas 11a to 11l, Chemical Formulas 12a to 12o, and Chemical Formulas 13a to 13i may be given.



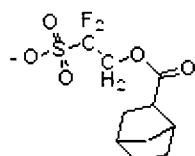
[Chemical Formula 11a]



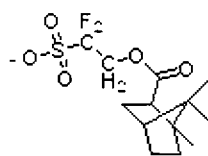
[Chemical Formula 11b]



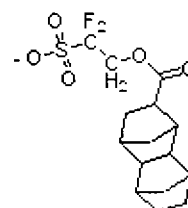
[Chemical Formula 11c]



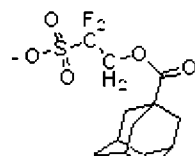
[Chemical Formula 11d]



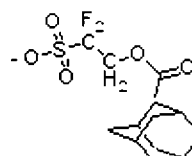
[Chemical Formula 11e]



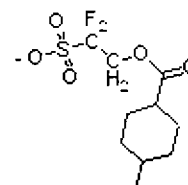
[Chemical Formula 11f]



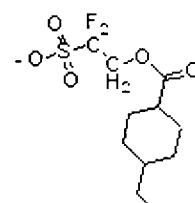
[Chemical Formula 11g]



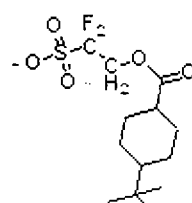
[Chemical Formula 11h]



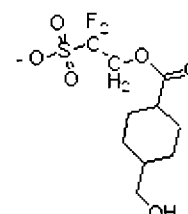
[Chemical Formula 11i]



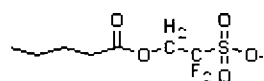
[Chemical Formula 11j]



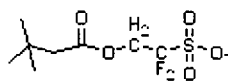
[Chemical Formula 11k]



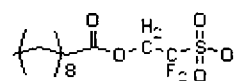
[Chemical Formula 11l]



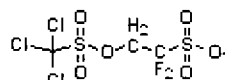
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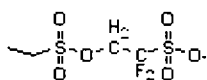
[Chemical Formula 12b]



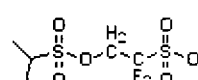
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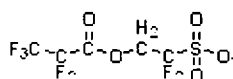
[Chemical Formula 12d]



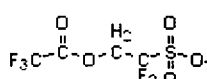
[Chemical Formula 12e]



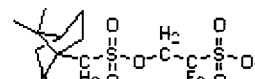
[Chemical Formula 12f]



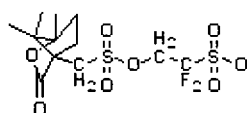
[Chemical Formula 12g]



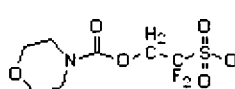
[Chemical Formula 12h]



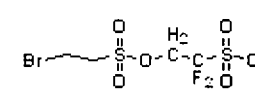
[Chemical Formula 12i]



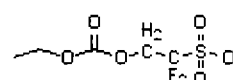
[Chemical Formula 12j]



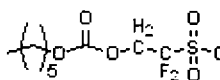
[Chemical Formula 12k]



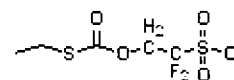
[Chemical Formula 12l]



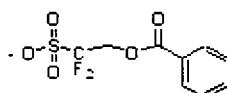
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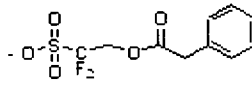
[Chemical Formula 12n]



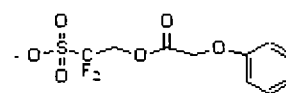
[Chemical Formula 12o]



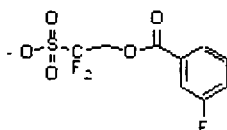
[Chemical Formula 13a]



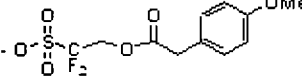
[Chemical Formula 13b]



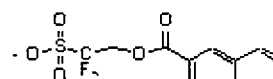
[Chemical Formula 13c]



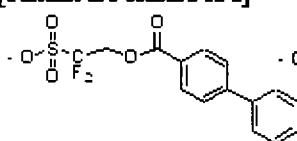
[Chemical Formula 13d]



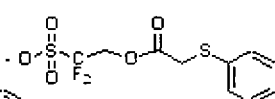
[Chemical Formula 13e]



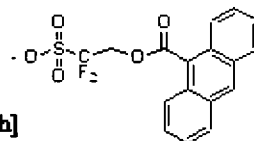
[Chemical Formula 13f]



[Chemical Formula 13g]



[Chemical Formula 13h]



[Chemical Formula 13i]

An amount of the PAG may be 0.3 to 15 parts by weight based on 100 parts by weight of the entire photoresist composition, and preferably 2 to 10 parts by weight. In this instance, when the amount of the PAG is less than 0.3 part by weight, acid-generation may be reduced, causing a reduction in resolution and deterioration in curved

shape of the pattern. When the amount of the PAG exceeds 15 parts by weight, the acid-generation may be significantly increased, causing a thickness loss of an upper portion of the resist film. Also, light-absorption of the PAG may be increased, causing deterioration in transparency of a resin, and significant reduction in perpendicularity of the pattern.

The solvent included in the chemically amplified photoresist composition is not particularly limited as long as the chemically amplified photoresist composition is capable of dissolving a solid of the photoresist composition, and has an appropriate drying speed and viscosity, however, for example, ethyleneglycol monomethyl ether, ethyleneglycol monoethyl ether, ethyleneglycol monopropyl ether, methylcellosolve acetate, ethylcellosolve acetate, propyleneglycol monomethyl ether acetate, propyleneglycol monoethyl ether acetate, propyleneglycol monopropyl ether acetate, methyl isopropyl keton, cyclohexanone, methyl 2-hydroxypropionate, ethyl 2-hydroxypropionate, 2-heptanone, ethyl lactate, gamma butyrolactone, and the like may be used alone, or in a combination of two or more as the solvent. An amount of the solvent may be adjusted depending on physical properties of the solvent, that is, volatility, viscosity, and the like, so that the solvent is uniformly formed on a wafer.

A method of forming the above described pattern on a substrate using the chemically amplified photoresist composition according to exemplary embodiments will be herein described in detail. Here, the method of forming the pattern may be a method of forming a photoresist pattern on the substrate, however, the present invention is not limited thereto. For example, the present invention may include a method of forming a pattern of a semiconductor device and/or display device using the photoresist pattern, such as a transistor, a capacitor, a metal wiring, and the like.

The method of forming the pattern according to exemplary embodiments may include forming the photoresist film by coating and drying the chemically amplified photoresist composition on the substrate, selectively exposing the photoresist film, and developing the photoresist film, which will be herein described in detail in a stepwise manner.

First, the chemically amplified photoresist composition may be coated on a prepared substrate. The substrate is not particularly limited, and for example, one of a silicon wafer, a glass substrate, and flexible substrate, and the like may be arbitrarily selected. As a method of coating the photoresist composition, one of techniques such as spin coating, precipitation, spraying, transfer, spill coating, roll coating, and the like may be arbitrarily selected.

Next, a light may be irradiated on the photoresist composition coated on the substrate, or a heat may be applied to the photoresist composition. Through this, the solvent of the photoresist composition may be vaporized to form a photoresist film. In this instance, the photoresist film may be slightly cured.

Next, the photoresist film may be selectively exposed. Here, this selective exposure may designate exposing the photoresist film in order to form a desired photoresist pattern. For example, a mask may be used to form the desired photoresist pattern when selectively exposing. A light source when exposing may be selectively used from I-ray, KrF excimer laser of far ultra violet, ArF excimer laser, F2 excimer laser, X-ray, and electro beam of charged particle beam, depending on a type of the PAG. An optical wavelength of the light source may be arbitrarily selected from 180 nm to 250 nm, as necessary. After the exposing, the exposed photoresist film may be cured, as necessary.

Next, the exposed photoresist film may be developed using a developing solution. Through this, the photoresist pattern may be formed. As the developing solution, for example, sodium hydroxide, potassium hydroxide, soda ash, sodium silicate, methan sodium silicate, aqueous ammonia, ethylamine, n-propylamine, triethylamine, tetramethylammonium hydroxide, tetraethylammonium hydroxide, and the like may be used alone or in a combination of two or more. Of these, an aqueous solution containing tetramethylammonium hydroxide may be used.

The photoresist, formed using the chemically amplified photoresist composition including the polymer polymerized using the acrylic monomer according to exemplary embodiments, may be less substrate-dependency, and excellent in transparency, contrast, sensitivity, resolution, and developing property. Also, the photoresist may have etching resistance. Using the photoresist, a semiconductor device including an ultra-minute pattern may be manufactured.

Hereinafter, the present invention will be described in detail by examples. It is to be understood, however, that these examples are for illustrative purpose only, and are not construed to limit the scope of the present invention.

[Examples]

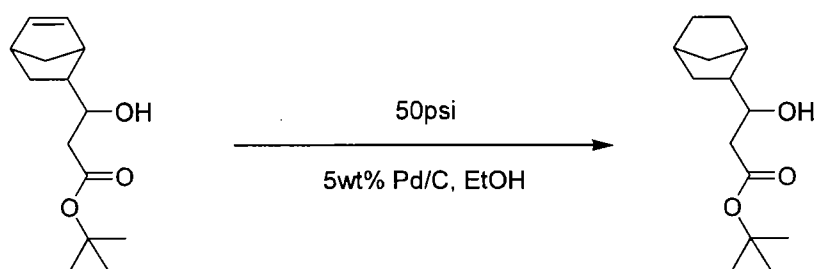
1. Monomer Synthesis

Synthesis Example 1: intermediate product synthesis

300g of 3-bicyclo[2.2.1]hept-5-en-2-yl-3-hydroxy-propionic acid tert-butyl ester (BHP) was dissolved in 1.5 L of ethanol, and was subjected to a hydrogenation reaction under a catalyst of Pd/C in a condition of 50 psi and room temperature, using an autoclave device (see Chemical Equation 1 below). After a reaction period of six hours, the catalyst of Pd/C was removed using a celite filter, and then a solvent was

removed. Next, a reactive was again dissolved in hexane and washed using distilled water, and thereby only an organic layer was separated. Next, 265 g of a monomer, that is, an intermediate product was obtained by removing the solvent, and a structure of the monomer was observed by a ^1H -NMR spectrum (see FIG. 1). In this instance, the monomer is represented as Chemical Formula 14 below.

[Chemical Equation 1]

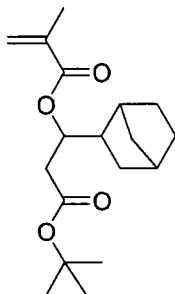


[Chemical Formula 14]

Synthesis Example 2: acrylic monomer synthesis

In a two-neck round flask including a stirrer and a reflux condenser mounted thereon, 100 g of the intermediate product obtained from Synthesis Example 1, 65.8 g of pyridine, 20.3 g of dimethyl amiopyridine, and 0.26 g of inorganox1010 were dissolved in 700 mL of ethylacetate, and then 87 g of 2-methyl-acryloyl chloride was slowly dropped under the injection of a nitrogen gas at room temperature. Next, a stirring was performed for about 20 minutes at room temperature, a mixed solution was refluxed for overnight at 50°C, and then was cooled to room temperature. Next, the solution was washed using distilled water after subjected to acid-basic treatment, and only an organic layer was separated. Next, a solvent was completely removed to obtain 103 g of a 2-methyl-acrylic acid 1-bicyclo[2.2.1]hept-2-yl-2-tert-butoxycarbonyl-ethyl ester (MA-BHP) monomer, that is, a compound represented as Chemical Formula 15 below, and a ^1H -NMR of the monomer is shown in FIG. 2.

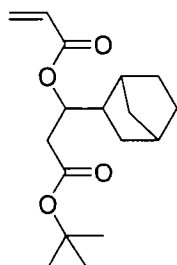
[Chemical Formula 15]



Synthesis Example 3 : acrylic monomer synthesis

In a two-neck round flask including a stirrer and a reflux condenser mounted thereon, 100 g of the intermediate product obtained from Synthesis Example 1, 65.8 g of pyridine, 20.3 g of dimethyl amiopyridine, and 0.24 g of inorganox1010 were dissolved in 700 mL of ethylacetate, and then 75 g of acryloyl chloride was slowly dropped under the injection of a nitrogen gas at room temperature. Next, a stirring was performed for about 20 minutes at room temperature, a mixed solution was refluxed for overnight at 50°C, and then was cooled to room temperature. Next, the solution was washed using distilled water after subjected to acid-basic treatment, and only an organic layer was separated. Next, a solvent was completely removed to obtain 95 g of an acrylic acid 1-bicyclo[2.2.1]hept-2-yl-2-tert-butoxycarbonyl-ethyl ester (A-BHP) monomer, that is, a compound represented as Chemical Formula 16 below.

[Chemical Formula 16]



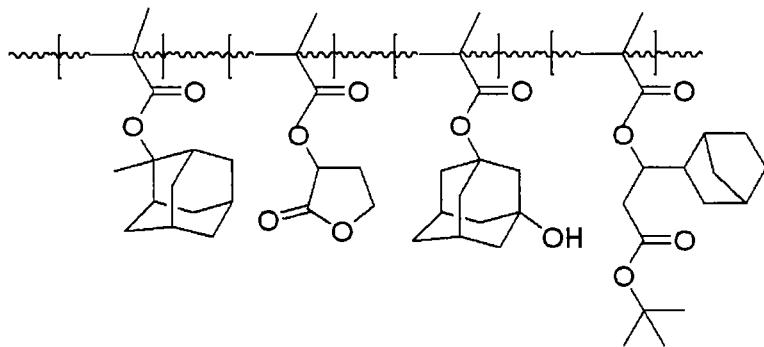
2. Polymer synthesis

Synthesis Example 4

In a flask where 115 g of 1,4-dioxane was inserted, 3.5 g of dimethyl azobisisobutyrate, that is, a polymerization initiator was added and dissolved. Next, an interior of the flask was substituted with nitrogen using a nitrogen gas, and an internal temperature of a reactor was heated to 70°C. When the internal temperature of the reactor was at 70°C, 7.5 g of MA-BHP, 20 g of methyl adamantane methacrylate, 12 g of γ -butyrolactyl methacrylate, and 17 g of hydroxy adamantane methacrylate were dissolved in 58 g of 1,4-dioxane, and then a solution was slowly dropped in the flask for two hours using a syringe pump. Next, the solution was reacted for 5 hours at 70°C, and the completely polymerized solution was cooled to room temperature. Next, a relatively large amount of the cooled solution was precipitated using n-hexane. Next, a filtrate was washed using the n-hexane, and dried under reduced pressure to obtain 45 g of a synthesized polymer, and a structure of the polymer was observed by a ^1H -NMR spectrum (see FIG. 3). In this instance, the obtained polymer is represented as Chemical Formula 9b below. Next, characteristics of the synthesized polymer was estimated using a GPC, and an estimated result is shown in FIG. 4. The GPC was performed in a condition that a system was DM400+External RI, a column was G4000Hhr+G2500Hhr, a solvent was THF, a flow rate was 1.000 mL/min, a concentration was 0.000mg/mL, and Inj. Vol was 100.0 μL . As a result of the GPC, a weight-average molecular weight (Mw) of the polymer in terms of polystyrene was 7,959, a number-average molecular weight (Mn) of the polymer was 4,189, and a molecular weight distribution (Mw/Mn) of the polymer was 19.0. In addition, the condition of the GPC was applied in Synthesis Examples, which will be described as

below, in the same manner.

[Chemical Formula 9b]



Synthesis Example 5

In a flask where 110 g of 1,4-dioxane was inserted, 4.1 g of norbornene, that is, a monomer for polymerization and 3.3 g of dimethyl azobisisobutyrate, that is, a polymerization initiator were added and dissolved. Next, an interior of the flask was filled with nitrogen using a nitrogen gas, and an internal temperature of a reactor was heated to 70°C. When the internal temperature of the reactor was at 70°C, 7 g of MA-BHP, 15 g of isopropyl adamantane methacrylate, 5 g of methyl adamantane methacrylate, 15 g of norbornane carbolactone methacrylate, and 16 g of hydroxy adamantane methacrylate were dissolved in 55 g of 1,4-dioxane, and then a solution was slowly dropped in the flask for two hours using a syringe pump. Next, the solution was reacted for 5 hours at 70°C, and the completely polymerized solution was cooled to room temperature. Next, a relatively large amount of the cooled solution was precipitated using n-hexane. Next, a filtrate was washed using the n-hexane, and dried under reduced pressure to obtain 49 g of a synthesized polymer, and a structure of the polymer was observed by a ^1H -NMR spectrum (see FIG. 5). In this instance, the obtained polymer is represented as Chemical Formula 9c below. Next, characteristics of the synthesized polymer was estimated using a GPC, and an estimated result is

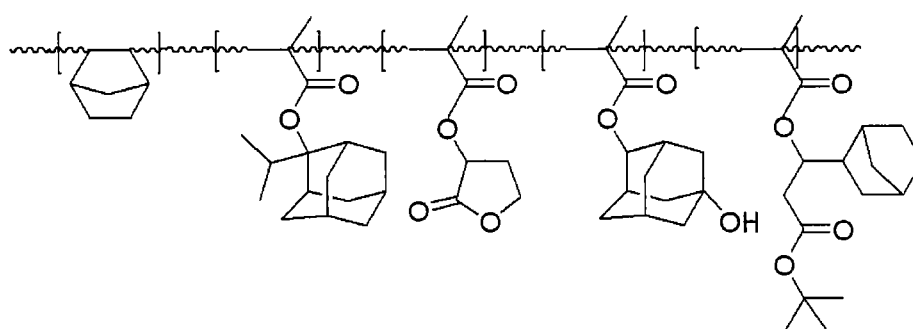
[Chemical Formula 9c]

The chemical structure represents a poly(ether amide) copolymer. The backbone is composed of repeating units of 1,4-bis(oxocarbonyl)adamantane and 1,4-bis(oxocarbonyl)adamantane-2,6-diol. The side chains are 1,4-bis(oxocarbonyl)adamantane-2,6-diol and 1,4-bis(oxocarbonyl)adamantane-2,6-diol. The structure is shown as a linear chain with wavy lines indicating the polymer backbone.

In a flask where 105 g of 1,4-dioxane was inserted, 4 g of norbornene, that is, a monomer for polymerization and 3 g of dimethyl azobisisobutyrate, that is, a polymerization initiator were added and dissolved. Next, an interior of the flask was purged with nitrogen using a nitrogen gas, and an internal temperature of a reactor was raised to 70°C. When the internal temperature of the reactor was at 70°C, 6.7 g of 2-methyl-2-propyl-1,3-dioxane, 20 g of isopropyl adamantane methacrylate, 11 g of γ -butyrolactyl methacrylate, and 15 g of hydroxy adamantane methacrylate were dissolved in 53 g of 1,4-dioxane, and then a solution was slowly dropped in the flask for two hours using a dropping funnel. Next, the solution was reacted for 5 hours at 70°C, and the completely polymerized solution was cooled to room temperature. Next, a relatively large amount of n-hexane was added to the cooled solution and the solution was precipitated using n-hexane. Next, a filtrate was washed with n-hexane, and dried under reduced pressure to obtain 35 g of a synthesized polymer, and a structure of the polymer was observed by a $^1\text{H-NMR}$ spectrum (see FIG. 1).

7). In this instance, the obtained polymer is represented as Chemical Formula 9e below. Next, characteristics of the synthesized polymer was estimated using a GPC, and an estimated result is shown in FIG. 8. As a result of the GPC, a weight-average molecular weight (M_w) of the polymer in terms of polystyrene was 6,793, a number-average molecular weight (M_n) of the polymer was 3,739, and a molecular weight distribution (M_w/M_n) of the polymer was 1.82.

[Chemical Formula 9e]

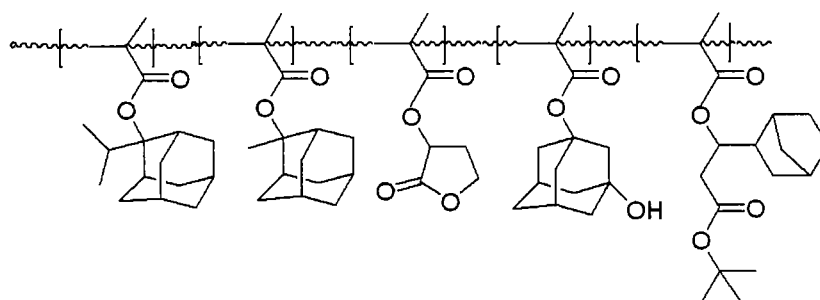


Synthesis Example 7

In a flask where 110 g of 1,4-dioxane was inserted, 3.3 g of dimethyl azobisisobutyrate, that is, a polymerization initiator were added and dissolved. Next, an interior of the flask was filled with nitrogen using a nitrogen gas, and an internal temperature of a reactor was heated to 70°C. When the internal temperature of the reactor was at 70°C, 7 g of MA-BHP, 15 g of isopropyl adamantane methacrylate, 5.3 g of methyl adamantane methacrylate, 11g of γ -butyrolactyl methacrylate, and 16 g of hydroxy adamantane methacrylate were dissolved in 50 g of 1,4-dioxane, and then a solution was slowly dropped in the flask for two hours using a syringe pump. Next, the solution was reacted for 5 hours at 70°C, and the completely polymerized solution was cooled to room temperature. Next, a relatively large amount of the cooled solution was precipitated using n-hexane. Next, a filtrate was washed using the n-

hexane, and dried under reduced pressure to obtain 49 g of a synthesized polymer, and a structure of the polymer was observed by a $^1\text{H-NMR}$ spectrum (see FIG. 9). In this instance, the obtained polymer is represented as Chemical Formula 9h below. Next, characteristics of the synthesized polymer was estimated using a GPC, and an estimated result is shown in FIG. 10. As a result of the GPC, a weight-average molecular weight (M_w) of the polymer in terms of polystyrene was 7,057, a number-average molecular weight (M_n) of the polymer was 3,819, and a molecular weight distribution (M_w/M_n) of the polymer was 1.85.

[Chemical Formula 9h]

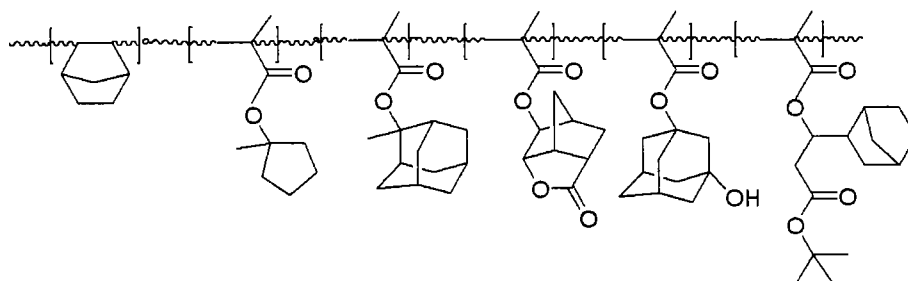


Synthesis Example 8

In a flask where 120 g of 1,4-dioxane was inserted, 4 g of norbornene, that is, a monomer for polymerization and 3.5 g of dimethyl azobisisobutyrate, that is, a polymerization initiator were added and dissolved. Next, an interior of the flask was filled with nitrogen using a nitrogen gas, and an internal temperature of a reactor was heated to 70°C. When the internal temperature of the reactor was at 70°C, 8 g of MA-BHP, 10 g of 2-methyl cyclopentyl methacrylate, 5 g of methyl adamantane methacrylate, 17 g of norbornane carbolactone methacrylate, and 18 g of hydroxy adamantane methacrylate were dissolved in 60 g of 1,4-dioxane, and then a solution was slowly dropped in the flask for two hours using a syringe pump. Next, the solution

was reacted for 5 hours at 70°C, and the completely polymerized solution was cooled to room temperature. Next, a relatively large amount of the cooled solution was precipitated using n-hexane. Next, a filtrate was washed using the n-hexane, and dried under reduced pressure to obtain 55 g of a synthesized polymer, and a structure of the polymer was observed by a ¹H-NMR spectrum (see FIG. 11). In this instance, the obtained polymer is represented as Chemical Formula 9i below. Next, characteristics of the synthesized polymer was estimated using a GPC, and an estimated result is shown in FIG. 12. As a result of the GPC, a weight-average molecular weight (Mw) of the polymer in terms of polystyrene was 8,465, a number-average molecular weight (Mn) of the polymer was 3,701, and a molecular weight distribution (Mw/Mn) of the polymer was 2.29.

[Chemical Formula 9i]



3. Manufacture of chemically amplified photoresist composition

Examples 1 to 10

100 parts by weight of the polymer obtained from each of Synthesis Examples 4 to 7, 4 parts by weight of triphenyl sulfonium nonaflate acting as the PAG, and 0.2 part by weight of tetramethylammonium hydroxide acting as a basic additive were dissolved in 1,000 parts by weight of propylene glycol methyl ester acetate acting as a solvent, and a solution was filtered using a membrane filter having a thickness of 0.2

μm to thereby manufacture a chemically amplified photoresist composition (see Table 1 below) in accordance with Examples 1 to 10.

[Table 1]

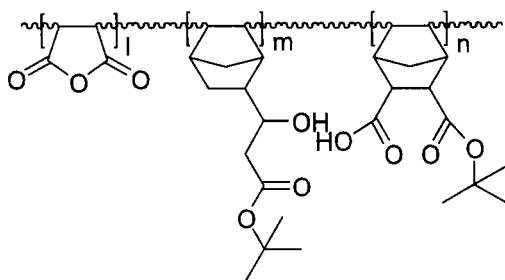
	Polymer (part by weight)	PAG (part by weight)	Basic additive (part by weight)	Solvent (part by weight)
Example 1	Synthesis Example 4, (100)	4	0.2	1,000
Example 2	Synthesis Example 5, (100)	4	0.2	1,000
Example 3	Synthesis Example 6, (100)	4	0.2	1,000
Example 4	Synthesis Example 7, (100)	4	0.2	1,000
Example 5	Synthesis Example 5, (100)	5	0.2	1,000
Example 6	Synthesis Example 6, (100)	5	0.2	1,000

	(100)			
Example 7	Synthesis Example 7, (100)	5	0.2	1,000
Example 8	Synthesis Example 5, (100)	5	0.3	1,000
Example 9	Synthesis Example 6, (100)	5	0.3	1,000
Example 10	Synthesis Example 7, (100)	5	0.3	1,000

Comparative Examples 1 to 3

A chemically amplified photoresist composition in accordance with Comparative Examples 1 to 3 was manufactured in the same manner as that of Examples 1 to 10, except that a COMA resin (manufacturer : Kumho) represented as Chemical Formula 17 below was used as the polymer, and an amount of each of the PAG and the basic additive was shown in Table 2 below.

[Chemical Formula 17]



[Table 2]

	Polymer (part by weight)	PAG (part by weight)	Basic additive (part by weight)	Solvent (part by weight)
Comparative Example 1	Chemical Formula 17 (100)	2.5	0.02	15
Comparative Example 2	Chemical Formula 17 (100)	3.0	0.02	14
Comparative Example 3	Chemical Formula 17 (100)	3.0	0.03	16.5

4. Characteristics estimation of chemically amplified photoresist composition

Each of the chemically amplified photoresist composition in accordance with Examples 1 to 10 and Comparative Examples 1 to 3 was coated on a substrate using a spinner, and dried for 90 seconds at 110°C to form a film having a thickness of 0.2 μm .

Next, an ArF excimer laser stepper (numerical aperture: 0.78) was used on a formed film to be exposed, and was subjected to a heat-treatment for 90 seconds at 110°C. Next, the resulting film was developed, washed, and dried using 2.38 wt% of a tetramethylammonium hydroxide aqueous solution for 40 seconds to thereby form a photoresist pattern.

After or during the above described process of forming the photoresist pattern, developing property of the photoresist, adhesive properties with the substrate, sensitivity, and resolution were estimated with respect to the tetramethylammonium hydroxide aqueous solution. In a case of the adhesive property, an adhesive state with the substrate of the photoresist pattern formed after developing, that is, a line and space (L/S) pattern was observed to be estimated. Also, when an amount of exposure formed by the L/S pattern with a line width of 1:1 is used as an optimal amount of exposure, the optimal amount of exposure may be the sensitivity, and a resolved minimal pattern dimension may be the resolution. In this instance, results of the sensitivity and the resolution are shown in Table 3 below.

	Sensitivity (mJ/ cm ²)	resolution (nm)
Example 1	10	90
Example 2	15	90
Example 3	15	80
Example 4	15	100

Example 5	13	90
Example 6	13	80
Example 7	12	80
Example 8	16	100
Example 9	16	90
Example 10	15	100
Comparative Example 1	15	120
Comparative Example 2	14	110
Comparative Example 3	16.5	120

When using the chemically amplified photoresist composition manufactured by Examples 1 to 10, developing property and adhesive property of the photoresist were relatively good. As shown in Table 3, the sensitivities of Examples 1 to 5 were more excellent than those of Comparative Examples 1 to 3. Also, the resolutions of Examples 1 to 10 were more excellent than those of Comparative Examples 1 to 3.

Although a few exemplary embodiments of the present invention have been

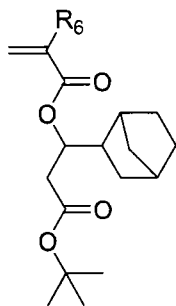
shown and described, the present invention is not limited to the described exemplary embodiments. Instead, it would be appreciated by those skilled in the art that changes may be made to these exemplary embodiments without departing from the principles and spirit of the invention, the scope of which is defined by the claims and their equivalents.

WHAT IS CLAIMED IS:

1. An acrylic monomer having a t-butoxycarbonyl group (t-BOC group) at its distal end.

2. The acrylic monomer of claim 1, wherein the acrylic monomer is represented as Chemical Formula (I),

[Chemical Formula (I)]

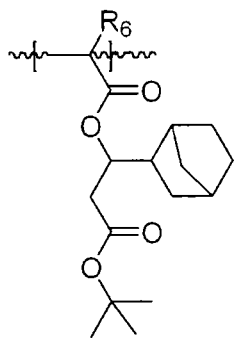


where R₆ denotes either hydrogen or a methyl group.

3. A polymer where a mixture including an acrylic monomer is polymerized, the acrylic monomer having a t-BOC group at its distal end.

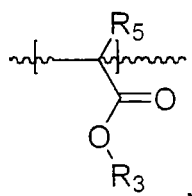
4. The polymer of claim 3, wherein the polymer includes a recurring unit being represented as Chemical Formulas (II) and (III), respectively

[Chemical Formula (II)]



where R_6 denotes either hydrogen or a methyl group, and

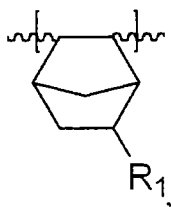
[Chemical Formula (III)]



where R_3 denotes either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including any one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group, and R_5 denotes either hydrogen or a methyl group.

5. The polymer of claim 4, wherein the polymer further includes a recurring unit being represented as Chemical Formula (IV),

[Chemical Formula (IV)]



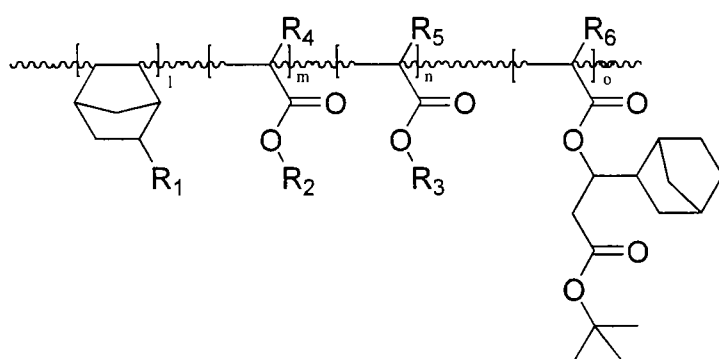
where R_1 denotes either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including one of hydrogen atoms, an ether group, an ester

group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group.

6. The polymer of claim 4, wherein a number of the recurring unit represented as Chemical Formula (III) is at least two, and the at least two recurring units are different from each another.

7. The polymer of claim 3, wherein the polymer is represented as Chemical Formula (V),

[Chemical Formula (V)]



where R_1 , R_2 , and R_3 separately denote either a C_1 to C_{30} alkyl group or a C_1 to C_{30} cycloalkyl group, each group including or not including one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group, R_4 , R_5 and R_6 separately denote either hydrogen group or a methyl group, and l , m , n and o respectively denote a numeral value indicating a recurring unit within a main chain, each numeral value satisfying $l + m + n + o = 1$, $0 \leq l / (l + m + n + o) < 0.4$, $0 < m / (l + m + n + o) < 0.6$, $0 \leq n / (l + m + n + o) < 0.6$, $0 < o / (l + m + n + o) < 0.4$.

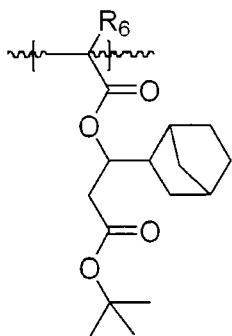
8. The polymer of claim 7, wherein I of Chemical Formula (V) satisfies $0.1 \leq 1 / (1 + m + n + o) < 0.4$.

9. The polymer of claim 3, wherein the polymer has an average molecular weight in terms of polystyrene of 2,000 to 1,000,000, and a molecular weight distribution of 1 to 5.

10. A chemically amplified photoresist composition, the photoresist composition including a polymer, a Photo Acid Generator (PAG), and a solvent, the polymer where a mixture including an acrylic monomer is polymerized, the acrylic monomer having a t-BOC group at its distal end.

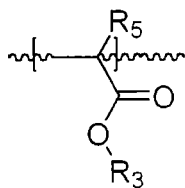
11. The photoresist composition of claim 10, wherein the polymer includes a recurring unit being represented as Chemical Formulas (II) and (III),

[Chemical Formula (II)]



where R₆ denotes either hydrogen or a methyl group, and

[Chemical Formula (III)]

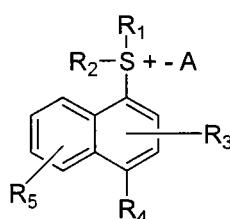
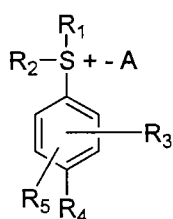


where R₃ denotes either a C₁ to C₃₀ alkyl group or a C₁ to C₃₀ cycloalkyl group, each group including or not including one of hydrogen atoms, an ether group, an ester group, a carbonyl group, an acetyl group, an epoxy group, a nitril group, and an aldehyde group, and R₅ denotes either hydrogen or a methyl group.

12. The photoresist composition of claim 10, wherein the polymer is in a ratio of 3 to 20 parts by weight based on 100 parts by weight of a total amount of the photoresist composition.

13. The photoresist composition of claim 10, wherein the PAG is at least one of compounds being represented as Chemical Formula (VI) and (VII), respectively

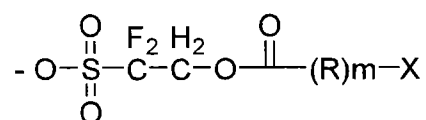
[Chemical Formula VI] and [Chemical Formula VII]



where R₁ and R₂ separately denote any one of an alkyl group, an allyl group, a perfluoroalkyl group, a benzyl group, and an aryl group, R₃, R₄ and R₅ separately denote one of hydrogen atoms, an alkyl group, a halogen group, an alkoxy group, an aryl group, a thiophenoxy group, a thioalkoxy group, and an alkoxycarbonylmethoxy group, and -A denotes a compound represented as one of ⁻OSO₂CF₃, ⁻OSO₂C₄F₉,

OSO₂C₈F₁₇, N(CF₃)₂, N(C₂F₅)₂, N(C₄F₉)₂, C(CF₃)₃, C(C₂F₅)₃, C(C₄F₉)₃, and Chemical Formula (VIII),

[Chemical Formula (VIII)]



where X denotes one of a monocyclic or polycyclic C₃ to C₃₀ hydrocarbon group, a benzyl group, a C₆ to C₂₀ aryl group, a C₁ to C₂₀ alkyl group, a C₁ to C₂₀ alkyl halide group, a C₁ to C₂₀ alkylsulfonyl group, a C₁ to C₂₀ alkoxy group, a C₁ to C₂₀ allyl group, and a C₁ to C₂₀ cyano group, at least one hydrogen atom of one of the monocyclic or polycyclic C₃ to C₃₀ hydrocarbon group, the benzyl group, the C₆ to C₂₀ aryl group, the C₁ to C₂₀ alkyl group, the C₁ to C₂₀ alkyl halide group, the C₁ to C₂₀ alkylsulfonyl group, the C₁ to C₂₀ alkoxy group, and the C₁ to C₂₀ allyl group is substituted with one of an ether group, an ester group, a carbonyl group, an acetal group, a nitril group, a cyano group, a hydroxyl group, a carboxyl group, and an aldehyde group, R denotes one of a C₁ to C₁₀ alkyl group, a C₁ to C₁₀ alkoxy group, a nitrogen atom, a sulfur atom, a fluorine atom, and an oxygen atom, and m denotes an integer of 0 to 2.

14. The photoresist composition of claim 10, wherein the PAG is in a ratio of 0.3 to 15 parts by weight based on 100 parts by weight of an entire solid of the photoresist composition.