

METHOD FOR USING COMPOSITION COMPRISING CARBOXYLIC
ACID ESTER, LITHOGRAPHY COMPOSITION COMPRISING
CARBOXYLIC ACID ESTER, AND METHOD FOR MANUFACTURING
RESIST PATTERN

5

BACKGROUND OF THE INVENTION

TECHNICAL FIELD

[0001] The present invention relates to a method for
10 using a composition comprising a carboxylic acid ester to
reduce standing wave in a lithography process. The
present invention also relates to a lithography
composition comprising a carboxylic acid ester, and
methods for manufacturing a resist pattern and a device
15 using the lithography composition.

BACKGROUND ART

[0002] In recent years, needs for high integration of LSI
has been increasing, and refining of patterns is required.
20 In order to respond such needs, lithography processes
using KrF excimer laser (248 nm), ArF excimer laser
(193 nm), extreme ultraviolet ray (EUV; 13 nm), X-ray
of short wavelength, electron beam or the like have been
put to practical use. In order to respond to such
25 refining of resist patterns, also for photosensitive resin
compositions to be used as a resist during refining
processing, those having high resolution are required.
Finer patterns can be formed by exposing with light of a
short wavelength, but high dimensional accuracy is
30 required.

For example, there is also a study of suppressing
fine irregularities on the resist surface by making a
certain acid generator be comprised in the resist
composition itself (Patent Document 1).

35 [0003] In the lithography process, a resist pattern is
formed by exposing and developing the resist. The

phenomenon in which at the time of exposure, the incident light on the resist and the reflected light from the substrate or the air interface interfere with each other to generate standing wave is known. The generation of standing wave reduces the pattern dimensional accuracy. Attempts have been made to form an anti-reflective coating on the top layer and/or bottom layer of the resist to reduce standing wave.

10 PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0004] [Patent document 1] JP H11-125907 A

15 BRIEF DESCRIPTION OF THE DRAWING

[0005] [Figure 1] Figure 1 is a schematic illustration showing the cross-sectional view of a negative type resist pattern when affected by standing wave.

[Figure 2] Figure 2 is a schematic illustration showing the cross-sectional view of a negative type resist pattern when not affected by standing wave.

SUMMARY OF THE INVENTION

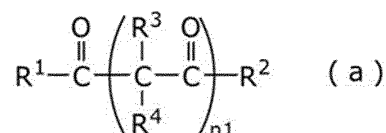
25 PROBLEMS TO BE SOLVED BY THE INVENTION

[0006] The present inventors have focused on controlling the movement of acids in a chemical process in which fine processing is performed. For example, even if an anti-reflective coating is formed on a substrate in a lithography process and a resist film is formed thereon and exposed, standing wave sometimes remains, and a further procedure is required. Further, since the bottom anti-reflective coating needs to be removed after the resist pattern is formed, it cannot sometimes be used in the process or another measure is sometimes needed to be taken.

The present inventors considered that there are one or more problems still need improvements. Examples of these include the following: reducing standing wave in the lithography process; reducing standing wave in the resist pattern; suppressing the non-uniformity of resist pattern width; suppressing the pattern collapse in the resist pattern; obtaining a resist pattern of good shape; obtaining a resist film with good sensitivity; obtaining a resist film with good resolution; obtaining a finer pattern; controlling the movement of acid in the chemical process; suppressing the moving speed of acid in the chemical process; and improving the yield of the lithography process.

MEANS FOR SOLVING THE PROBLEMS

[0007] The present invention is to provide a method for using a composition comprising a carboxylic acid ester (A) to reduce standing wave in a lithography process, wherein the carboxylic acid ester (A) is represented by the formula (a):



where

R^1 is C_{1-10} alkyl or $-OR^{1'}$,

R^2 is $-OR^{2'}$,

$R^{1'}$ and $R^{2'}$ are each independently C_{1-20} hydrocarbon,

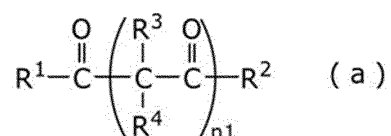
R^3 and R^4 are each independently H or C_{1-10} alkyl,

R^1 and R^3 or R^4 , or R^2 and R^3 or R^4 can be bonded to form a saturated or unsaturated hydrocarbon ring, and

n_1 is 1 or 2,

provided that when n_1 is 1, at least one of R^1 or $R^{1'}$, and $R^{2'}$ is C_{3-20} hydrocarbon.

[0008] The lithography composition according to the present invention comprises a carboxylic acid ester (A) and a solvent (B), wherein the carboxylic acid ester (A) is represented by the formula (a):



where

R^1 is C_{1-10} alkyl or $-\text{OR}^{1'}$,

R^2 is $-\text{OR}^{2'}$,

$\text{R}^{1'}$ and $\text{R}^{2'}$ are each independently C_{1-20} hydrocarbon,

R^3 and R^4 are each independently H or C_{1-10} alkyl,

R^1 and R^3 or R^4 , or R^2 and R^3 or R^4 can be bonded to form a saturated or unsaturated hydrocarbon ring, and

$n1$ is 1 or 2,

provided that when $n1$ is 1, at least one of R^1 or $\text{R}^{1'}$, and $\text{R}^{2'}$ is C_{3-20} hydrocarbon.

[0009] The method for manufacturing a film according to the present invention comprises the following steps:
 (1) applying the above-described lithography composition above a substrate; and
 (2) forming a film from the lithography composition under reduced pressure and/or heating.

EFFECTS OF THE INVENTION

[0010] According to the present invention, it is possible to expect one or more of the following effects.

It is possible to reduce standing wave in the lithography process. It is possible to reduce standing wave in the resist pattern. It is possible to suppress the non-uniformity of resist pattern width. It is possible to suppress the pattern collapse in the resist pattern. It

is possible to obtain a resist pattern of good shape. It is possible to obtain a resist film with good sensitivity. It is possible to obtain a resist film with good resolution. It is possible to obtain a finer pattern. It is possible to control the movement of acid in the chemical process. It is possible to suppress the moving speed of acid in the chemical process. It is possible to improve the yield of the lithography process.

10 DETAILED DESCRIPTION OF THE INVENTION

MODE FOR CARRYING OUT THE INVENTION

[0011] Embodiments of the present invention are described below in detail.

15 [0012] Definition

Unless otherwise specified in the present specification, the definitions and examples described in this paragraph are followed.

20 The singular form includes the plural form and "one" or "that" means "at least one". An element of a concept can be expressed by a plurality of species, and when the amount (for example, mass % or mol %) is described, it means sum of the plurality of species.

25 "And/or" includes a combination of all elements and also includes single use of the element.

When a numerical range is indicated using "to" or "-", it includes both endpoints and units thereof are common. For example, 5 to 25 mol % means 5 mol % or more and 25 mol % or less.

30 The descriptions such as "C_{x-y}", "C_x-C_y" and "C_x" mean the number of carbons in a molecule or substituent. For example, C₁₋₆ alkyl means an alkyl chain having 1 or more and 6 or less carbons (methyl, ethyl, propyl, butyl, pentyl, hexyl etc.).

35 When polymer has a plural types of repeating units, these repeating units copolymerize. These

copolymerization may be any of alternating copolymerization, random copolymerization, block copolymerization, graft copolymerization, or a mixture thereof. When polymer or resin is represented by a structural formula, n, m or the like that is attached next to parentheses indicate the number of repetitions.

Celsius is used as the temperature unit. For example, 20 degrees means 20 degrees Celsius.

The additive refers to a compound itself having a function thereof (for example, in the case of a base generator, a compound itself that generates a base). An embodiment in which the compound is dissolved or dispersed in a solvent and added to a composition is also possible. As one embodiment of the present invention, it is preferable that such a solvent is contained in the composition according to the present invention as the solvent (B) or another component.

[0013] <Method for using a composition comprising a carboxylic acid ester>

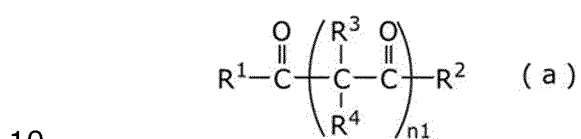
The present invention relates to a method for using a composition comprising a carboxylic acid ester (A) (hereinafter sometimes referred to as the composition used in the present invention) to reduce standing wave in a lithography process.

Preferably, the composition used in the present invention is used for being applied above a substrate to form a film. According to the present invention, standing wave can be reduced, so that no bottom anti-reflective coating has to be formed in the lower layer of the composition used in the present invention. Therefore, applying the composition used in the present invention without forming any bottom anti-reflective coating is also a preferred embodiment of the present invention. Further, since the effect of further reduction of standing wave can be exhibited when a bottom anti-reflective coating is formed, the present invention can be

used even when a bottom anti-reflective coating is formed. The composition for the use method of the present invention is preferably the lithography composition described later.

5 [0014] Carboxylic acid ester (A)

The carboxylic acid ester (A) (hereinafter sometimes referred to as the component (A); the same applies to (B) onward described later) is represented by the formula (a):



wherein

15 R^1 is C_{1-10} alkyl or $-OR^{1'}$; preferably C_{1-10} alkyl; more preferably C_{1-5} alkyl. The C_{1-5} alkyl is preferably methyl, ethyl, isopropyl, n-butyl or t-butyl; more preferably methyl or t-butyl; further preferably methyl. When $n1$ is 2, it is preferable that R^1 is $-OR^{1'}$.

R^2 is $-OR^{2'}$.

$R^{1'}$ and $R^{2'}$ are each independently C_{1-20} hydrocarbon.

20 $R^{1'}$ is preferably C_{1-5} alkyl; more preferably methyl or ethyl; further preferably methyl.

25 $R^{2'}$ is preferably C_{3-20} hydrocarbon; more preferably C_{3-20} alkyl, C_{6-20} aryl or C_{6-20} arylalkyl; more preferably isopropyl, sec-butyl, t-butyl, n-butyl, n-heptyl or benzyl; further preferably, isopropyl, t-butyl or benzyl.

30 Although not to be bound by theory, in $-OR^{2'}$, the carbon adjacent to the oxygen is preferably a tertiary carbon atom. It is considered that this is because the tertiary carbon atom is easily eliminated and contributes to lowering the moving speed of the acid.

In another embodiment, when $n1$ is 2, $R^{2'}$ is preferably C_{1-5} alkyl; more preferably methyl or ethyl;

further preferably methyl.

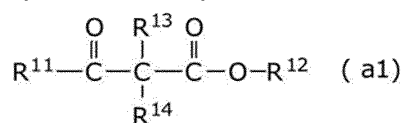
R^3 and R^4 are each independently H or C_{1-10} alkyl; preferably H or C_{1-5} alkyl; more preferably H, methyl or t-butyl; and further preferably both are H. When n_1 is 2, R^3 occurs twice in one carboxylic acid ester (A), but these two R^3 can be identical to or different from each other; and preferably, these are identical. The same applies to R^4 .

R^1 and R^3 or R^4 , or R^2 and R^3 or R^4 can be bonded to form a saturated or unsaturated hydrocarbon ring. When n_1 is 2, $(CR^3R^4-C(=O)-)$ to which n_1 attached is repeated twice, and R^3 and R^4 occur twice, and in this case, it is preferable that the above-described bond binds the closer group. For example, of the two R^3 , R^3 that is closer to R^1 preferably binds R^1 . It is a preferred embodiment of the present invention that R^1 and R^3 or R^4 do not bind. It is a preferred embodiment of the present invention that R^2 and R^3 or R^4 do not bind.

n_1 is 1 or 2; preferably n_1 is 1. As another embodiment of the present invention, it is also preferred that n_1 is 2.

When n_1 is 1, at least one of R^1 or $R^{1'}$, and $R^{2'}$ is C_{3-20} hydrocarbon; preferably $R^{2'}$ is C_{3-20} hydrocarbon.

[0015] Preferably, the carboxylic acid ester (A) is represented by the formula (a1):



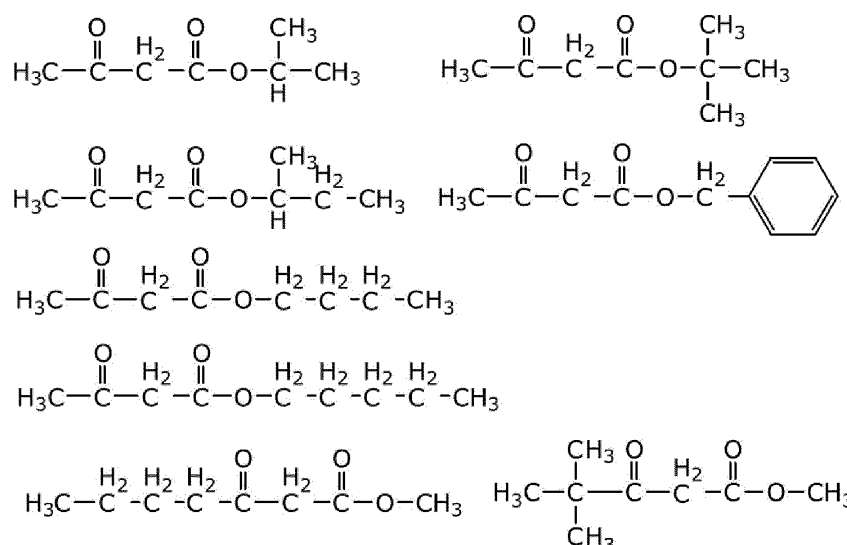
wherein

R^{11} is C_{1-5} alkyl; preferably methyl. R^{12} is C_{3-20} hydrocarbon; preferably C_{3-7} alkyl; more preferably isopropyl, sec-butyl, t-butyl, n-butyl or n-heptyl; further preferably isopropyl or t-butyl; further more preferably t-butyl. The carbon adjacent to the oxygen in R^{12} is preferably a tertiary carbon atom.

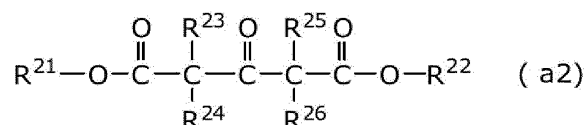
R^{13} and R^{14} are each independently H or C_{1-5} alkyl;

and preferably, both are H.

[0016] Although there is no intention to limit the present invention, exemplified embodiments of the carboxylic acid ester (A) include the following. Compounds in which n1 is 1 in the formula (a), or the carboxylic acid ester (A) represented by the formula (a1) fall under these.



[0017] In one embodiment of the present invention, the carboxylic acid ester (A) is represented by the formula (a2):



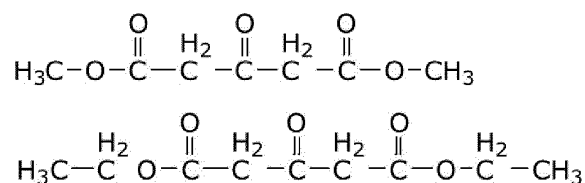
wherein

R²¹ and R²² are C₁₋₅ alkyl, preferably methyl or ethyl.

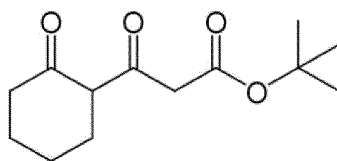
R²³, R²⁴, R²⁵ and R²⁶ are each independently H or C₁₋₅ alkyl, preferably H, and more preferably all are H.

[0018] Although there is no intention to limit the present invention, exemplified embodiments of the carboxylic acid ester (A) include the following. Compounds in which n1 is 2 in the formula (a), or the carboxylic acid

ester (A) represented by the formula (a2) fall under these.



[0019] The following compound is one example of the
 5 carboxylic acid ester (A) of the present invention. The
 following compound can be represented by the formula
 (a). For example, it can be read that n1 is 2, R¹ is C₃
 alkyl (n-propyl), R^{2'} is t-butyl, two R³ are both H, R⁴
 close to R¹ is methyl, R⁴ close to R² is H, and R¹ close to
 10 R⁴ and R¹ are combined to form a saturated hydrocarbon
 ring (cyclohexyl).



[0020] Although not to be bound by theory, it is
 considered that the incorporation of the carboxylic acid
 15 ester (A) into the composition used in the present
 invention can reduce standing wave because it
 contributes to suppressing the moving speed of the
 substance generated in the film during the lithography
 process (for example, acid generated from the acid
 20 generator (D)).

[0021] Solvent (B)

The composition used in the present invention
 preferably comprises a solvent (B). The preferred
 solvent (B) is the same as that indicated for the
 25 lithography composition to be described later.

The content of the carboxylic acid ester (A) based
 on the solvent (B) is preferably 1.0 to 200 mass %;
 more preferably 2 to 150 mass %; further preferably 2.5

to 120 mass %; further more preferably 2.5 to 50 mass %.

[0022] Film-forming component (C)

5 The composition used in the present invention preferably comprises a film-forming component (C). The preferred film-forming component (C) is the same as that indicated for the lithography composition to be described later.

10 The content of the carboxylic acid ester (A) based on the film-forming component (C) is preferably 10 to 3,000 mass %; more preferably 20 to 2,000 mass %; further preferably 30 to 1,000 mass %; further more preferably 60 to 900 mass %.

[0023] <Lithography composition>

15 The lithography composition according to the present invention comprises a carboxylic acid ester (A) represented by the formula (a) and a solvent (B).

In the present invention, the lithography composition refers to a composition used in a
20 photolithography process, for example, which is used for cleaning and film forming, and in particular, a resist composition, a planarization film forming composition, and a bottom anti-reflective coating forming composition, an top anti-reflective coating forming
25 composition, a rinsing solution, a resist remover, and the like. The lithography composition may or may not be removed after carrying out the process; and preferably, it is removed. The one formed from the lithography composition may or may not remain in the final device;
30 and preferably, it does not remain.

The lithography composition according to the present invention is a lithography film forming composition, more preferably a resist composition. It can be used in either a positive type or a negative type,
35 but preferably, it is a negative type resist composition.

Further, the lithography composition according to

the present invention is preferably a chemically amplified type resist composition, more preferably a chemically amplified negative type resist composition, and in this case, in addition to the components (A) and (B),
5 preferably it comprises polymer, an acid generator and a crosslinking agent to be described later.

[0024] Carboxylic acid ester (A)

The carboxylic acid ester (A) used in the lithography composition of the present invention is as
10 described above, and the preferred embodiments are the same as described above.

The content of the carboxylic acid ester (A) based on the solvent (B) is preferably 1.0 to 200 mass %; more preferably 2 to 150 mass %; further preferably 2.5
15 to 120 mass %; further more preferably 2.5 to 50 mass %.

[0025] Solvent (B)

The solvent (B) used in the present invention is not particularly limited as long as it can dissolve each
20 component to be compounded. Here, the solvent (B) shall not include those that fall under the above-described carboxylic acid ester (A).

The solvent (B) preferably comprises an organic solvent (B1). It is also a preferable embodiment that
25 the solvent (B) consists only of the solvent (B1). The organic solvent (B1) preferably comprises a hydrocarbon solvent, an ether solvent, an ester solvent, an alcohol solvent, a ketone solvent, or a mixture of any of these.

Exemplified embodiments of the solvent include
30 water, n-pentane, i-pentane, n-hexane, i-hexane, n-heptane, i-heptane, 2,2,4-trimethylpentane, n-octane, i-octane, cyclohexane, methylcyclohexane, benzene, toluene, xylene, ethylbenzene, trimethylbenzene, methylethylbenzene, n-propylbenzene, i-propylbenzene,
35 diethylbenzene, i-butylbenzene, triethylbenzene, di-i-propylbenzene, n-amyl naphthalene, trimethylbenzene,

methanol, ethanol, n-propanol, i-propanol, n-butanol, i-butanol, sec-butanol, t-butanol, n-pentanol, i-pentanol, 2-methylbutanol, sec-pentanol, t-pentanol, 3-methoxybutanol, n-hexanol, 2-methylpentanol, sec-hexanol, 2-ethylbutanol, sec-heptanol, heptanol-3, n-octanol, 2-ethylhexanol, sec-octanol, n-nonyl alcohol, 2,6-dimethylheptanol-4, n-decanol, sec-undecyl alcohol, trimethyl nonyl alcohol, sec-tetradecyl alcohol, sec-heptadecyl alcohol, phenol, cyclohexanol, methylcyclohexanol, 3,3,5-trimethylcyclohexanol, benzyl alcohol, phenylmethyl carbinol, diacetone alcohol, cresol, ethylene glycol, propylene glycol, 1,3-butylene glycol, pentanediol-2,4, 2-methylpentanediol-2,4, hexanediol-2,5, heptanediol-2,4, 2-ethylhexanediol-1,3, diethylene glycol, dipropylene glycol, triethylene glycol, tripropylene glycol, glycerin, acetone, methyl ethyl ketone, methyl n-propyl ketone, methyl n-butyl ketone, diethyl ketone, methyl i-butyl ketone, methyl n-pentyl ketone, ethyl n-butyl ketone, methyl n-hexyl ketone, di-i-butyl ketone, trimethylnonane, cyclohexanone, cyclopentanone, methylcyclohexanone, 2,4-pentanedione, acetonylacetone, diacetone alcohol, acetophenone, fenthion, ethyl ether, i-propyl ether, n-butyl ether (di-n-butyl ether, DBE), n-hexyl ether, 2-ethylhexyl ether, ethylene oxide, 1,2-propylene oxide, dioxolane, 4-methyl dioxolane, dioxane, dimethyl dioxane, ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, ethylene glycol diethyl ether, ethylene glycol mono-n-butyl ether, ethylene glycol mono-n-hexyl ether, ethylene glycol monophenyl ether, ethylene glycol mono-2-ethyl butyl ether, ethylene glycol dibutyl ether, diethylene glycol monomethyl ether, diethylene glycol monoethyl ether, diethylene glycol diethyl ether, diethylene glycol mono-n-butyl ether, diethylene glycol di-n-butyl ether, diethylene glycol mono-n-hexyl ether, ethoxytriglycol, tetraethylene glycol

di-n-butyl ether, propylene glycol monomethyl ether (PGME), propylene glycol monoethyl ether, propylene glycol monopropyl ether, propylene glycol monobutyl ether, dipropylene glycol monomethyl ether, dipropylene glycol monoethyl ether, dipropylene glycol monopropyl ether, dipropylene glycol monobutyl ether, tripropylene glycol monomethyl ether, tetrahydrofuran, 2-methyltetrahydrofuran, diethyl carbonate, methyl acetate, ethyl acetate, γ -butyrolactone, γ -valerolactone, n-propyl acetate, i-propyl acetate, n-butyl acetate (normal butyl acetate, nBA), i-butyl acetate, sec-butyl acetate, n-pentyl acetate, sec-pentyl acetate, 3-methoxybutyl acetate, methylpentyl acetate, 2-ethylbutyl acetate, 2-ethylhexyl acetate, benzyl acetate, cyclohexyl acetate, methyl cyclohexyl acetate, n-nonyl acetate, ethylene glycol monomethyl ether acetate, ethylene glycol monoethyl ether acetate, diethylene glycol monomethyl ether acetate, diethylene glycol monoethyl acetate, diethylene glycol mono-n-butyl ether acetate, propylene glycol monomethyl ether acetate, propylene glycol monoethyl ether acetate, propylene glycol monopropyl ether acetate, propylene glycol monobutyl ether acetate, dipropylene glycol monomethyl ether acetate, dipropylene glycol monoethyl ether acetate, glycol diacetate, methoxytriglycol acetate, ethyl propionate, n-butyl propionate, i-amyl propionate, diethyl oxalate, di-n-butyl oxalate, methyl lactate, ethyl lactate (EL), n-butyl lactate, n-amyl lactate, diethyl malonate, dimethyl phthalate, diethyl phthalate, propylene glycol 1-monomethyl ether 2-acetate (PGMEA), propylene glycol monoethyl ether acetate, propylene glycol monopropyl ether acetate, N-methylformamide, N,N-dimethylformamide, N,N-diethylformamide, acetamide, N-methylacetamide, N,N-dimethylacetamide, N-methylpropionamide, N-methyl pyrrolidone, dimethyl sulfide, diethyl sulfide, thiophene,

tetrahydrothiophene, dimethyl sulfoxide, sulfolane, and 1,3-propane sultone. These solvents can be used alone or in combination of two or more of these.

5 The solvent (B) is preferably PGME, PGMEA, EL, nBA, DBE or a mixture of any of these, and more preferably PGME, EL, nBA, DBE or a mixture of any of these. In another embodiment of the present invention, PGME, PGMEA or a mixture thereof is also suitable as the solvent (B).

10 [0026] In relation to other layers or films, it is also one embodiment that the solvent (B) substantially contains no water. For example, the amount of water in the total solvent (B) is preferably 0.1 mass % or less, more preferably 0.01 mass % or less, further preferably 0.001 mass % or less. It is also a preferable embodiment that the solvent (B) contains no water (0 mass %).

[0027] The content of the solvent (B) based on the lithography composition is preferably 10 to 98 mass %; more preferably 20 to 98 mass %; further preferably 30 to 97 mass %; further more preferably 40 to 95 mass %.

[0028] Assuming that the boiling points of the carboxylic acid ester (A) and the solvent (B) are respectively bp_A and bp_B , and that the saturated vapor pressures at 25°C and 1 atm are respectively vp_{CA} and vp_{CB} , it is preferable to satisfy $bp_A > bp_B$ and $vp_{CA} < vp_{CB}$.

[0029] Film-forming component (C)

30 The lithography composition according to the present invention preferably comprises a film-forming component (C). In the present invention, the film-forming component (C) refers to a component that constitutes at least a part of the film to be formed. The film to be formed does not have to consist only of the film-forming component (C). For example, the film-forming component (C) and the crosslinking agent (E) described later can combine to form a film. In a

preferred aspect, the film-forming component (C) constitutes most of the film to be formed, for example, 60% or more per volume of the film (more preferably 70% or more; further preferably 80% or more; further more preferably 90% or more).

[0030] The film-forming component (C) preferably comprises polymer (C1). A preferred embodiment of the present invention is that the film-forming component (C) is polymer (C1).

Examples of the polymer (C1) include novolak derivatives, phenol derivatives, polystyrene derivatives, polyacrylic acid derivatives, polymaleic acid derivatives, polycarbonate derivatives, polyvinyl alcohol derivatives, polymethacrylic acid derivatives, and copolymers in combination of any of these.

[0031] When the lithography composition according to the present invention is a resist composition, it is preferable that the polymer (C1) is polymer generally used in a resist composition whose solubility in an alkaline developer changes due to exposure or the like.

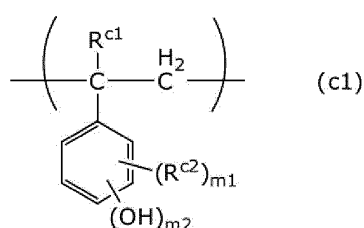
When the lithography composition according to the present invention is a chemically amplified positive type resist composition, the polymer (C1) is preferably one that reacts with an acid to increase its solubility in a developer. Such polymer has, for example, an acid group protected by a protective group, and when an acid is added from outside, the protective group is eliminated and the solubility in a developer is increased.

When the lithography composition according to the present invention is a chemically amplified negative type resist composition, the polymer (C1) is preferably one that crosslinks between the polymers, for example, by a crosslinking agent using an acid generated by exposure as a catalyst to reduce its solubility in a developer.

Such polymer can be freely selected from those generally used in the lithography method. Among such

polymer, one having at least one repeating unit represented by the following formulas (c1), (c2) and (c3) is preferable. When the lithography composition according to the present invention is a chemically amplified negative type resist composition, it is preferable that the polymer (C1) has at least a repeating unit represented by the formula (c1).

[0032] The repeating unit represented by the formula (c1) is as shown below:



wherein

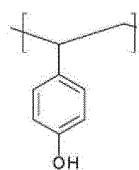
R^{c1} is H, C_{1-5} alkyl, C_{1-5} alkoxy or $-\text{COOH}$, preferably H or methyl, more preferably H,

R^{c2} is C_{1-5} alkyl (where $-\text{CH}_2-$ can be replaced with $-\text{O}-$), preferably methyl, ethyl or methoxy, more preferably methyl,

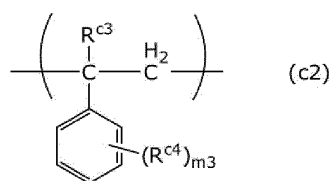
m_1 is a number of 0 to 4, preferably 0, and

m_2 is a number of 1 to 2, preferably 1, and $m_1 + m_2 \leq 5$.

[0033] An exemplified embodiment of the formula (c1) is as shown below:



[0034] The structural unit represented by the formula (c2) is as shown below:



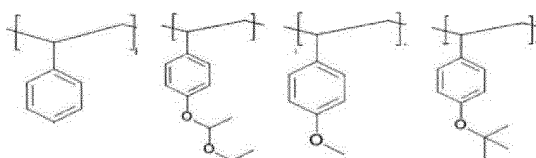
wherein

$\text{R}^{\text{c}3}$ is H, C_{1-5} alkyl, C_{1-5} alkoxy or $-\text{COOH}$, preferably hydrogen or methyl, more preferably hydrogen.

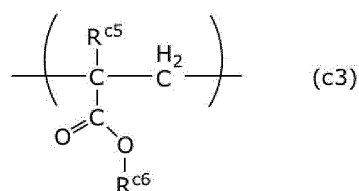
$\text{R}^{\text{c}4}$ is C_{1-5} alkyl or C_{1-5} alkoxy (where $-\text{CH}_2-$ contained in the alkyl or alkoxy can be replaced with $-\text{O}-$), more preferably C_{1-5} alkoxy (where $-\text{CH}_2-$ contained in the alkoxy can be replaced with $-\text{O}-$), and at this time, m_3 is preferably 1. Examples of $\text{R}^{\text{c}4}$ in this embodiment include methoxy, t-butyloxy and $-\text{O}-\text{CH}(\text{CH}_3)-\text{O}-\text{CH}_2\text{CH}_3$.

m_3 is a number of 0 to 5, preferably 0, 1, 2, 3, 4 or 5, more preferably 0 or 1. It is also a suitable embodiment that m_3 is 0.

[0035] An exemplified embodiment of the formula (c2) is as shown below:



[0036] The structural unit represented by the formula (c3) is as shown below:

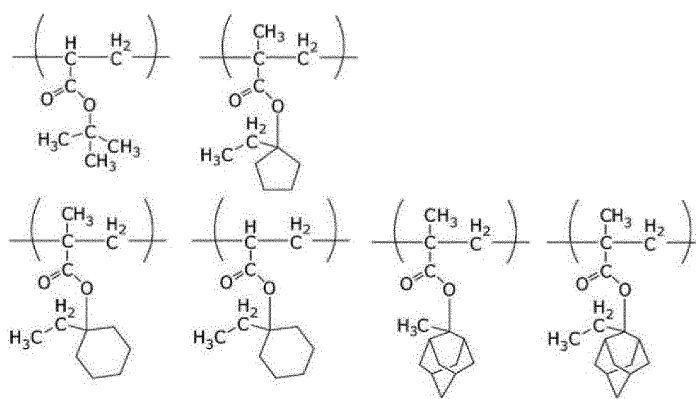


wherein

$\text{R}^{\text{c}5}$ is H, C_{1-5} alkyl, C_{1-5} alkoxy or $-\text{COOH}$, more preferably H, methyl, ethyl, methoxy or $-\text{COOH}$, further preferably hydrogen or methyl, further more preferably H.

R^{C6} is a C_{1-15} alkyl or C_{1-5} alkyl ether, R^{C6} can have a ring structure, and R^{C6} is preferably methyl, isopropyl, t-butyl, cyclopentyl, methylcyclopentyl, ethylcyclopentyl, methylcyclohexyl, ethylcyclohexyl, methyl adamantyl or ethyl adamantyl, more preferably t-butyl, ethylcyclopentyl, ethylcyclohexyl or ethyl adamantyl, further preferably t-butyl.

[0037] Exemplified embodiments of the formula (c3) are as shown below:



[0038] Since these structural units are appropriately compounded according to the purpose, their compounding ratio is not particularly limited, but it is preferable to compound them so that the solubility in an alkaline developer becomes appropriate.

These polymer can also be used in combination of two or more types.

[0039] The mass average molecular weight (hereinafter sometimes referred to as Mw) of the polymer (C1) is preferably 500 to 100,000; more preferably 1,000 to 50,000; further preferably 3,000 to 20,000; further more preferably 4,000 to 20,000.

In the present invention, Mw can be measured by the gel permeation chromatography (GPC). In this measurement, it is a preferable example to use a GPC column at 40°C, an eluent tetrahydrofuran at 0.6 mL/min, and mono-dispersed polystyrene as a standard.

[0040] The content of the carboxylic acid ester (A) based on the film-forming component (C) is preferably 10 to 3,000 mass %; more preferably 20 to 2,000 mass %; further preferably 30 to 1,000 mass %; further more preferably 60 to 900 mass %.

The content of the film-forming component (C) based on the lithography composition is preferably 2 to 40 mass %; more preferably 2 to 30 mass %; further preferably 3 to 25 mass %; further more preferably 3 to 20 mass %.

[0041] Assuming that the ratios of the repeating units represented by the formulas (c1), (c2) and (c3) are respectively n_{c1} , n_{c2} and n_{c3} based on the total number of repeating units in the polymer (C1), the following is one of the preferred embodiments of the present invention.

n_{c1} is 0 to 100%; more preferably 30 to 100%; further preferably 50 to 100%; further more preferably 60 to 100%.

n_{c2} is 0 to 100%; more preferably 0 to 70%; further preferably 0 to 50%; further more preferably 0 to 40%.

n_{c3} is 0 to 50%; more preferably 0 to 40%; further preferably 0 to 30%; further more preferably 0 to 20%.

An embodiment that contains no repeating unit represented by the formula (c3) (n_{c3} is 0) is also another preferred embodiment of the present invention.

[0042] Acid generator (D)

The lithography composition according to the present invention can comprise an acid generator (D). In the present invention, the acid generator refers to a compound itself having an acid generating function. Examples of the acid generator include a photoacid generator (PAG) that generates an acid by exposure and a thermal acid generator (TAG) that generates an acid by heating. When the lithography composition

according to the present invention is a chemically amplified type resist composition, it is preferable that a photoacid generator is contained.

[0043] Examples of the photoacid generator include
5 sulfonium salt, iodonium salt, sulfonyl diazomethane and N-sulfonyloxy imide acid generators. Typical photoacid acid generators are shown below, which can be used alone or in combination of two or more of these.

[0044] The sulfonium salt is a salt of an anion containing
10 a carboxylate, a sulfonate or an imide, and a sulfonium cation. Typical examples of the sulfonium cation include triphenyl sulfonium, (4-methylphenyl) diphenyl sulfonium, (4-methoxyphenyl) diphenyl sulfonium, tris(4-methoxyphenyl) sulfonium, (4-tert-butylphenyl)
15 diphenyl sulfonium, (4-tert-butoxyphenyl) diphenyl sulfonium, bis(4-tert-butoxyphenyl) phenyl sulfonium, tris(4-tert-butylphenyl) sulfonium, tris(4-tert-butoxyphenyl) sulfonium, tris(4-methylphenyl) sulfonium, (4-methoxy-3,5-dimethylphenyl) dimethyl
20 sulfonium, (3-tert-butoxyphenyl) diphenyl sulfonium, bis(3-tert-butoxyphenyl) phenyl sulfonium, tris(3-tert-butoxyphenyl) sulfonium, (3,4-di-tert-butoxyphenyl) diphenyl sulfonium, bis(3,4-di-tert-butoxyphenyl) phenyl sulfonium, tris(3,4-di-tert-butoxyphenyl) sulfonium, (4-phenoxyphenyl) diphenyl sulfonium, (4-cyclohexylphenyl) diphenyl sulfonium, bis(p-phenylene) bis(diphenylsulfonium), diphenyl (4-thiophenoxyphenyl) sulfonium, diphenyl (4-thiophenylphenyl) sulfonium, diphenyl (8-thiophenylbiphenyl) sulfonium, (4-tert-butoxycarbonylmethyloxyphenyl) diphenyl sulfonium,
30 tris(4-tert-butoxycarbonylmethyloxyphenyl) sulfonium, (4-tert-butoxyphenyl) bis(4-dimethylaminophenyl) sulfonium, tris(4-dimethylaminophenyl) sulfonium, 2-naphthyl diphenyl sulfonium, dimethyl (2-naphthyl)
35 sulfonium, 4-hydroxyphenyl dimethyl sulfonium, 4-methoxyphenyl dimethyl sulfonium, trimethyl sulfonium,

2-oxocyclohexyl cyclohexylmethyl sulfonium, trinaphthyl sulfonium, and tribenzyl sulfonium. Typical examples of the sulfonate include trifluoromethane sulfonate, nonafluorobutane sulfonate, heptadecafluorooctane sulfonate, 2,2,2-trifluoroethane sulfonate, 5 pentafluorobenzene sulfonate, 4-(trifluoromethyl)benzene sulfonate, 4-fluorobenzene sulfonate, toluene sulfonate, benzene sulfonate, 4-(4-toluene sulfonyloxy)benzene sulfonate, naphthalene 10 sulfonate, camphor sulfonate, octane sulfonate, dodecylbenzene sulfonate, butane sulfonate, and methane sulfonate. Typical examples of the imide include bis(perfluoromethanesulfonyl) imide, bis(perfluoroethanesulfonyl) imide, 15 bis(perfluorobutanesulfonyl) imide, bis(perfluorobutanesulfonyloxy) imide, and bis[perfluoro(2-ethoxyethane)sulfonyl] imide and N,N-hexafluoropropane-1,3-disulfonyl imide. Typical examples of the other anion include 3-oxo-3H-1,2- 20 benzothiazole-2-ide, 1,1-dioxide, tris[(trifluoromethyl)sulfonyl] methanide and tris[(perfluorobutyl)sulfonyl] methanide. Fluorocarbon-containing anions are preferred. Sulfonium salts based on the combination of the above examples are included.

25 [0045] The iodonium salt is a salt of an anion containing a sulfonate and an imide, and an iodonium cation. Typical examples of the iodonium cation include aryliodonium cations, such as diphenyl iodonium, bis(4-tert-butylphenyl) iodonium, bis(4-tert-pentylphenyl) 30 iodonium, 4-tert-butoxyphenylphenyl iodonium and 4-methoxyphenylphenyl iodonium. Typical examples of the sulfonate include trifluoromethane sulfonate, nonafluorobutane sulfonate, heptadecafluorooctane sulfonate, 2,2,2-trifluoroethane sulfonate, 35 pentafluorobenzene sulfonate, 4-(trifluoromethyl)benzene sulfonate, 4-fluorobenzene

sulfonate, toluene sulfonate, benzene sulfonate, 4-(4-toluene sulfonyloxy)benzene sulfonate, naphthalene sulfonate, camphor sulfonate, octane sulfonate, dodecylbenzene sulfonate, butane sulfonate, and methane sulfonate. Typical examples of the imide include bis(perfluoromethanesulfonyl) imide, bis(perfluoroethanesulfonyl) imide, bis(perfluorobutanesulfonyl) imide, bis(perfluorobutanesulfonyloxy) imide, bis[perfluoro(2-ethoxyethane)sulfonyl] imide and N,N-hexafluoropropane-1,3-disulfonyl imide. Typical examples of the other anion include 3-oxo-3H-1,2-benzothiazole-2-ide, 1,1-dioxide, tris[(trifluoromethyl)sulfonyl] methanide, and tris[(perfluorobutyl)sulfonyl] methanide. Fluorocarbon-containing anions are preferred. Iodonium salts based on the combination of the above examples are included.

[0046] Typical examples of the sulfonyldiazomethane compound include bissulfonyl diazomethane compounds and sulfonylcarbonyl diazomethane compounds, such as bis(ethylsulfonyl) diazomethane, bis(1-methylpropylsulfonyl) diazomethane, bis(2-methylpropylsulfonyl) diazomethane, bis(1,1-dimethylethylsulfonyl) diazomethane, bis(cyclohexylsulfonyl) diazomethane, bis(perfluoroisopropylsulfonyl) diazomethane, bis(phenylsulfonyl) diazomethane, bis(4-methylphenylsulfonyl) diazomethane, bis(2,4-dimethylphenylsulfonyl) diazomethane, bis(2-naphthylsulfonyl) diazomethane, 4-methylphenylsulfonylbenzoyl diazomethane, tert-butylcarbonyl-4-methylphenylsulfonyl diazomethane, 2-naphthylsulfonylbenzoyl diazomethane, 4-methylphenylsulfonyl-2-naphthoyl diazomethane, methylsulfonylbenzoyl diazomethane, and tert-butoxycarbonyl-4-methylphenylsulfonyl diazomethane.

- [0047] Examples of the N-sulfonyloxy imide photoacid generator include a combination of an imide skeleton and a sulfonic acid. Typical examples of the imide skeleton include succinimide, naphthalenedicarboxylic acid imide, phthalimide, cyclohexyldicarboxylic acid imide, 5-norbornene-2,3-dicarboxylic acid imide, and 7-oxabicyclo[2.2.1]-5-heptene-2,3-dicarboxylic acid imide. Typical examples of the sulfonate include trifluoromethane sulfonate, nonafluorobutane sulfonate, heptadecafluorooctane sulfonate, 2,2,2-trifluoroethane sulfonate, pentafluorobenzene sulfonate, 4-trifluoromethylbenzene sulfonate, 4-fluorobenzene sulfonate, toluene sulfonate, benzene sulfonate, naphthalene sulfonate, camphor sulfonate, octane sulfonate, dodecylbenzene sulfonate, butane sulfonate, and methane sulfonate.
- [0048] Examples of the benzoin sulfonate photoacid generator include benzointosylate, benzoinmesylate, and benzoinbutane sulfonate.
- [0049] Examples of the pyrogallol trisulfonate photoacid generator include pyrogallol, phloroglucinol, catechol, resorcinol and hydroquinone, in which all hydroxyl groups are substituted with trifluoromethane sulfonate, nonafluorobutane sulfonate, heptadecafluorooctane sulfonate, 2,2,2-trifluoroethane sulfonate, pentafluorobenzene sulfonate, 4-trifluoromethylbenzene sulfonate, 4-fluorobenzene sulfonate, toluene sulfonate, benzene sulfonate, naphthalene sulfonate, camphor sulfonate, octane sulfonate, dodecylbenzene sulfonate, butane sulfonate, or methane sulfonate.
- [0050] Examples of the nitrobenzyl sulfonate photoacid generator include 2,4-dinitrobenzyl sulfonates, 2-nitrobenzyl sulfonates, and 2,6-dinitrobenzyl sulfonates, and typically sulfonates including trifluoromethane sulfonate, nonafluorobutane sulfonate,

5 heptadecafluorooctane sulphonate, 2,2,2-trifluoroethane
sulphonate, pentafluorobenzene sulphonate, 4-
trifluoromethylbenzene sulphonate, 4-fluorobenzene
sulphonate, toluene sulphonate, benzene sulphonate,
naphthalene sulphonate, camphor sulphonate, octane
sulfonate, dodecylbenzene sulfonate, butane sulfonate,
and methane sulfonate. Further, useful ones are similar
nitrobenzyl sulfonate compounds in which the nitro
group on the benzyl side is substituted with
10 trifluoromethyl.

[0051] Examples of the sulfone photoacid generator
include bis(phenylsulfonyl)methane, bis(4-
methylphenylsulfonyl)methane, bis(2-
naphthylsulfonyl)methane, 2,2-
15 bis(phenylsulfonyl)propane, 2,2-bis(4-
methylphenylsulfonyl)propane, 2,2-bis(2-
naphthylsulfonyl)propane, 2-methyl-2-(p-
toluenesulfonyl)propiophenone, 2-cyclohexylcarbonyl-2-
(p-toluenesulfonyl)propane, and 2,4-dimethyl-2-(p-
toluenesulfonyl)pentan-3-one.
20

[0052] Examples of the photoacid generator in the form of
a glyoxime derivative include bis-O-(p-toluenesulfonyl)-
α-dimethylglyoxime, bis-O-(p-toluenesulfonyl)-α-
diphenylglyoxime, bis-O-(p-toluenesulfonyl)-α-
25 dicyclohexylglyoxime, bis-O-(p-toluenesulfonyl)-2,3-
pentandionglyoxime, bis-O-(p-toluenesulfonyl)-2-
methyl-3,4-pentanedione- glyoxime, bis-O-(n-
butanesulfonyl)-α-dimethylglyoxime, bis-O-(n-
butanesulfonyl)-α-diphenylglyoxime, bis-O-(n-
30 butanesulfonyl)-α-dicyclohexylglyoxime, bis-O-(n-
butanesulfonyl)-2,3-pentanedione glyoxime, bis-O-(n-
butanesulfonyl)-2-methyl-3,4-pentanedione- glyoxime,
bis-O-(methanesulfonyl)-α-dimethylglyoxime, bis-O-
(trifluoromethanesulfonyl)-α-dimethylglyoxime, bis-O-
35 (1,1,1-trifluoroethanesulfonyl)-α-dimethylglyoxime, bis-
O-(tert-butanesulfonyl)-α-dimethylglyoxime, bis-O-

5 (perfluorooctanesulfonyl)- α -dimethylglyoxime, bis-O-(cyclohexylsulfonyl)- α -dimethylglyoxime, bis-O-(benzenesulfonyl)- α -dimethylglyoxime, bis-O-(p-fluorobenzenesulfonyl)- α -dimethylglyoxime, bis-O-(p-tert-butylbenzenesulfonyl)- α -dimethylglyoxime, bis-O-(xylenesulfonyl)- α -dimethylglyoxime, and bis-O-(camphorsulfonyl)- α -dimethylglyoxime.

[0053] Among these, preferred PAG is sulfonium salts, iodonium salts and N-sulfonyloxy imides.

10 [0054] The optimal anion for the generated acid varies depending on factors such as the ease of cleavage of acid-labile groups in the polymer, but non-volatile and extremely non-diffusive anions are generally selected. Examples of the suitable anion include anions of
15 benzenesulfonic acid, toluenesulfonic acid, 4-(4-toluenesulfonyloxy)benzenesulfonic acid, pentafluorobenzenesulfonic acid, 2,2,2-trifluoroethanesulfonic acid, nonafluorobutanesulfonic acid, heptadecafluorooctanesulfonic acid,
20 camphorsulfonic acid, disulfonic acid, sulfonylimide and sulfonylmethaneide.

[0055] Examples of the thermal acid generator include metal-free sulfonium salts and iodonium salts, such as triarylsulfonium, dialkylarylsulfonium and
25 diarylalkylsulfonium salts of strong non-nucleophilic acids; alkylaryliodonium, diaryliodonium salts of strong non-nucleophilic acids; and ammonium, alkylammonium, dialkylammonium, trialkylammonium, tetraalkylammonium salts of strong non-nucleophilic
30 acids. Further, covalent thermal acid generators are also considered as useful additives, and examples thereof include 2-nitrobenzyl esters of alkyl or aryl sulfonic acids, and other esters of sulfonic acids that are thermally decomposed to give free sulfonic acids.
35 Examples thereof include diaryliodonium perfluoroalkyl sulfonate, diaryliodonium tris(fluoroalkylsulfonyl)

methide, diaryliodonium bis(fluoroalkylsulfonyl) methide, diaryliodonium bis(fluoroalkylsulfonyl) imide, and diaryliodonium quaternary ammonium perfluoroalkyl sulfonate. Examples of the labile ester include 2-nitrobenzyl tosylate and 2,4-dinitrobenzyl tosylate, 2,6-dinitrobenzyl tosylate, 4-nitrobenzyl tosylate; benzene sulfonates such as 2-trifluoromethyl-6-nitrobenzyl 4-chlorobenzene sulfonate and 2-trifluoromethyl-6-nitrobenzyl 4-nitrobenzene sulfonate; phenolic sulfonate esters such as phenyl 4-methoxybenzene sulfonate; quaternary ammonium tris(fluoroalkylsulfonyl) methides; quaternary alkylammonium bis(fluoroalkylsulfonyl) imides; and alkylammonium salts of organic acids such as triethylammonium salt of 10-camphorsulfonic acid. Various aromatic (anthracene, naphthalene or benzene derivatives) sulfonic acid amine salts such as those disclosed in U.S. Pat. No. 3,474,054, 4,200,729, 4,251,665 and 5,187, 019 can also be used as the TAG.

20 [0056] The acid generator (D) can be two or more kinds of compounds.

[0057] The content of the acid generator (D) based on the film-forming component (C) is preferably 0.5 to 20 mass %; more preferably 1.0 to 10 mass %; further preferably 1.0 to 5 mass %; further more preferably 1.5 to 4 mass %.

[0058] Crosslinking agent (E)

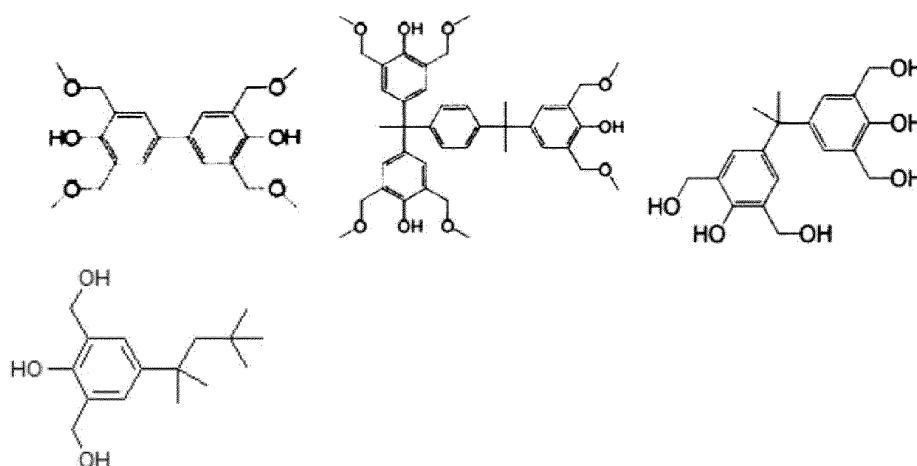
The lithography composition according to the present invention can comprise a crosslinking agent (E). In the present invention, the crosslinking agent refers to the compound itself having a crosslinking function. The crosslinking agent is not particularly limited as long as it crosslinks the component (C) intramolecularly and/or between the molecules.

35 [0059] Examples of the crosslinking agent include melamine compounds, guanamine compounds, glycoluril

compounds or urea compounds substituted by at least one group selected from a methylol group, an alkoxymethyl group and an acyloxymethyl group; epoxy compounds; thioepoxy compounds; isocyanate compounds; azide compounds; and compounds comprising a double bond such as an alkenyl ether group. Further, compounds comprising a hydroxy group can also be used as the crosslinking agent.

Examples of the epoxy compound include tris(2,3-epoxypropyl)isocyanurate, trimethylolmethane triglycidyl ether, trimethylolpropane triglycidyl ether and triethylolethane triglycidyl ether. Examples of the melamine compound include compounds derived by methoxymethylation of 1 to 6 methylol groups of hexamethylolmelamine, hexamethoxymethylmelamine or hexamethylolmelamine, and mixtures thereof; and compounds derived by acyloxymethylation of 1 to 6 methylol groups of hexamethoxyethylmelamine, hexaacyloxymethylmelamine or hexamethylolmelamine, and mixtures thereof. Examples of the guanamine compound include compounds derived by methoxymethylation of 1 to 4 methylol groups of tetramethylolguanamine, tetramethoxymethylguanamine or tetramethylolguanamine, and mixtures thereof; and compounds derived by acyloxymethylation of 1 to 4 methylol groups of tetramethoxyethylguanamine, tetraacyloxyguanamine or tetramethylolguanamine, and mixtures thereof. Examples of the glycoluril compound include compounds derived by methoxymethylation of 1 to 4 methylol groups of tetramethylolglycoluril, tetramethoxyglycoluril, tetramethoxymethylglycoluril or tetramethylolglycoluril, and mixtures thereof; and compounds derived by acyloxymethylation of 1 to 4 methylol groups of tetramethylolglycoluril, and mixtures thereof. Examples of the urea compound include compounds derived by

- methoxymethylation of 1 to 4 of methylol groups of tetramethylolurea, tetramethoxymethylurea or tetramethylolurea, and mixtures thereof;
- 5 tetramethoxyethylurea, and the like. Examples of the compound containing an alkenyl ether group include ethylene glycol divinyl ether, triethylene glycol divinyl ether, 1,2-propanediol divinyl ether, 1,4-butanediol divinyl ether, tetramethylene glycol divinyl ether, neopentyl glycol divinyl ether, trimethylolpropane trivinyl ether, hexanediol divinyl ether, 1,4-cyclohexanediol divinyl ether, pentaerythritol trivinyl ether, pentaerythritol tetravinyl ether, sorbitol tetravinyl ether, sorbitol pentavinyl ether, trimethylolpropane trivinyl ether, and the like.
- 10 [0060] Examples of the crosslinking agent containing a hydroxy group include the following:



- [0061] The crosslinking temperature for the film formation is preferably 50 to 230°C, further preferably 80 to 220°C, further more preferably 80 to 190°C.
- 20 [0062] The content of the crosslinking agent (E) based on the film-forming component (C) is preferably 3 to 30 mass %; more preferably 5 to 20 mass %.
- [0063] Basic compound (F)
- 25 The lithography composition according to the present invention can further comprise a basic

compound (F). The basic compound (F) has an effect of neutralizing the acid generated in the exposed region and suppressing the environmental influence.

5 In addition to the above effects, the basic compound also has the effect of suppressing the deactivation of the acid on the film surface due to the amine component contained in the air.

[0064] The basic compound (F) is preferably selected from the group consisting of ammonia, primary aliphatic
10 amines of C₁₋₁₆, secondary aliphatic amines of C₂₋₃₂, tertiary aliphatic amines of C₃₋₄₈, aromatic amines of C₆₋₃₀ and heterocyclic amines of C₅₋₃₀, and derivatives thereof.

[0065] Exemplified embodiments of the basic compound
15 include ammonia, ethylamine, n-octylamine, ethylenediamine, triethylamine, triethanolamine, tripropylamine, tributylamine, triisopropanolamine, diethylamine, tris[2-(2-methoxyethoxy)ethyl]amine, 1,8-diazabicyclo[5.4.0]undecene-7, 1,5-
20 diazabicyclo[4.3.0]nonen-5, 7-methyl-1,5,7-triazabicyclo[4.4.0]deca-5-ene and 1,5,7-triazabicyclo[4.4.0]deca-5-ene.

[0066] The molecular weight of the basic compound (F) is preferably 17 to 500, more preferably 100 to 350.

25 [0067] The content of the basic compound (F) based on the film-forming component (C) is preferably 0.01 to 1.0 mass %; more preferably 0.20 to 0.8 mass %; further preferably 0.20 to 0.5 mass %. From the viewpoint of the storage stability of the composition, it is also a
30 preferable embodiment that the composition contains no basic compound (F) (0.00 mass %).

[0068] Surfactant (G)

The lithography composition according to the present invention preferably comprises a surfactant (G).
35 The coatability can be improved by making a surfactant be comprised in the lithography composition according

to the present invention. Examples of the surfactant that can be used in the present invention include (I) anionic surfactants, (II) cationic surfactants or (III) nonionic surfactants, and particularly (I) alkyl sulfonate, alkyl benzene sulfonic acid and alkyl benzene sulfonate, (II) lauryl pyridinium chloride and lauryl methyl ammonium chloride and (III) polyoxyethylene octyl ether, polyoxyethylene lauryl ether, polyoxyethylene acetylenic glycol ether, fluorine-containing surfactants (for example, Fluorad (3M), Megafac (DIC), Surflon (AGC) and organic siloxane surfactants (for example, KF-53, KP341 (Shin-Etsu Chemical)) are included.

[0069] These surfactants can be used alone or in combination of two or more of these. The content of the surfactant (G) based on the film-forming component (C) is preferably 0.05 to 0.5 mass %, more preferably 0.09 to 0.2 mass %.

[0070] Additive (H)
The lithography composition according to the present invention can comprise an additive (H) other than the components (A) to (G). The additive (H) preferably comprises a plasticizer, a dye, a contrast enhancer, an acid, a radical generator, a substrate adhesion enhancer, an antifoaming agent, or a mixture of any of these.

The content of the additive (H) (in the case of a plurality, the sum thereof) based on the composition is preferably 0.1 to 20 mass %; more preferably 0.1 to 10 mass %; further preferably 1 to 5 mass %. It is also one embodiment of the present invention that the composition according to the present invention contains no additive (H) (0.0 mass %).

[0071] <Method for manufacturing a film>

The method for manufacturing a film according to the present invention comprises the following steps:
(1) applying the lithography composition according to

the present invention above a substrate; and
(2) forming a film from the lithography composition
under reduced pressure and/or heating.

5 Hereinafter, the numbers in parentheses indicate
the order of the steps. For example, when the steps
(1), (2) and (3) are described, the order of the steps is
as described above.

In the present invention, the film is one dried or
cured and is, for example, one includes a resist film.
10 According to the present invention, since the
influence of standing wave can be reduced during film
formation, any anti-reflective coating (for example, a
resist bottom anti-reflective coating) is not needed to be
formed above the substrate before applying the
15 lithography composition. It is preferable that no anti-
reflective coating is formed under the lithography
composition layer, because when an anti-reflective
coating is formed under the lithography composition
layer, it needs to be removed and because the
20 manufacturing process becomes simpler.

[0072] Hereinafter, one embodiment of the manufacturing
method according to the present invention is described.

The lithography composition according to the
present invention is applied above a substrate (for
25 example, a silicon/silicon dioxide-coated substrate, a
silicon nitride substrate, a silicon wafer substrate, a
glass substrate, an ITO substrate, and the like) by an
appropriate method. Here, in the present invention, the
“above” includes the case where a film is formed
30 immediately above a substrate and the case where a film
is formed above a substrate via another layer. For
example, a planarization film can be formed immediately
above a substrate, and the composition according to the
present invention can be applied immediately above the
35 planarization film. The application method is not
particularly limited, and examples thereof include a

method using a spinner or a coater. After application, the film according to the present invention is formed under reduced pressure and/or heating. The film can be formed by rotating the substrate at high speed and evaporating the solvent without heating. When the lithography composition according to the present invention is a resist composition, heating is performed, for example, using a hot plate. The heating temperature is preferably 80 to 250°C; more preferably 80 to 200°C; further preferably 90 to 180°C. The heating time is preferably 30 to 600 seconds; more preferably 30 to 300 seconds; further preferably 60 to 180 seconds. Heating is preferably carried out in an air or nitrogen gas atmosphere.

The film thickness of the resist film varies depending on the exposure wavelength, but is preferably 100 to 50,000 nm. When a KrF excimer laser is used for the exposure, the film thickness of the resist film is preferably 100 to 5,000 nm; more preferably 100 to 1,000 nm; further preferably 400 to 600 nm.

[0073] When the lithography composition according to the present invention is a resist composition, the method for manufacturing a resist pattern according to the present invention comprises the following steps:
forming a film using the lithography composition by the above-described method;
(3) exposing the film with radiation; and
(4) developing the film to form a resist pattern.

[0074] Exposure is performed to the film formed using the resist composition, through a predetermined mask. The wavelength of the light to be used for the exposure is not particularly limited, but it is preferable to expose with light having a wavelength of 13.5 to 365 nm. In particular, i-line (wavelength: 365 nm), KrF excimer laser (wavelength: 248 nm), ArF excimer laser (wavelength: 193 nm), extreme ultraviolet ray

(wavelength: 13.5 nm) and the like can be used, and preferred one is KrF excimer laser. These wavelengths allow a range of $\pm 1\%$. After exposure, post exposure bake can be performed, as necessary. The post exposure baking temperature is preferably 80 to 150°C, more preferably 100 to 140°C, and the heating time is 0.3 to 5 minutes, preferably 0.5 to 2 minutes.

The exposed film is developed using a developer. The developer to be used is preferably a tetramethylammonium hydroxide (TMAH) aqueous solution of 2.38 mass %. The temperature of the developer is preferably 5 to 50°C, more preferably 25 to 40°C, and the development time is preferably 10 to 300 seconds, more preferably 30 to 60 seconds.

Using such a developer, the film can be easily dissolved and removed at room temperature. Further, to these developers, for example, a surfactant can also be added.

When a negative type resist composition is used, the exposed region of the photoresist layer is removed by development to form a resist pattern. The resist pattern can be further made finer, for example, using a shrink material.

[0075] Figure 1 is a schematic illustration showing the cross-sectional view of a negative type resist pattern when affected by standing wave. A resist pattern 1 is formed on a substrate 2. When a waveform having a large amplitude is formed in the cross section in this way, the resist top shape greatly fluctuates with a slight difference in film thickness, and the dimensional accuracy deteriorates, so that it is preferable that such an amplitude is smaller. Here, upward from the point where the substrate and the resist pattern are in contact with each other, the first point where the width of the resist pattern becomes maximum is set as the antinode 3, and the point immediately above it where the width of

the resist pattern is the minimum is set as the node 4. Further, the distance between the antinode and the node in the direction parallel to the substrate is referred to as the internode distance 5. It is preferable that the internode distance is smaller, and particularly, the internode distance / desired pattern width (hereinafter sometimes referred to as the standing wave index) is preferably less than 10%, more preferably 5% or less. Here, the desired pattern width may be the width of the top of the resist when it is assumed not to be affected by standing wave. By reducing standing wave that appears in the resist pattern, pattern collapse, which is caused due to undesired shape or formation of a notch, is suppressed and stable formation of a finer pattern is facilitated.

Figure 2 is a schematic illustration showing the cross-sectional view of a negative type resist pattern when not affected by standing wave. In the negative resist, since the polymer is insolubilized through the acid generated by the exposure, it is difficult for light to reach the lower part and the acid is generated less than in the upper part, and the lower part is less insolubilized than the upper part. Therefore, the formed pattern tends to have a reverse tapered shape. In Figure 2, neither antinode nor node exists, and in this case, the standing wave index is considered to be zero.

[0076] The method for manufacturing a metal pattern according to the present invention comprises the following steps:
forming a resist pattern by the above-described method;
(5a) forming a metal layer on the resist pattern; and
(6a) removing the remaining resist pattern and the metal layer thereon. Subsequent to the steps (1) to (4), the steps (5a) and (6a) are carried out. The order of the steps is as described above.

The metal layer is formed, for example, by vapor

deposition or sputtering of a metal such as gold or copper (which can be a metal oxide or the like). After that, the resist pattern can be formed by removing the resist pattern together with the metal layer formed on the upper part of the resist pattern, using a stripper. The stripper is not particularly limited as long as it is one used as a stripper for resist, and for example, N-methylpyrrolidone (NMP), acetone, or an alkaline solution is used. When the resist according to the present invention is a negative type one, it tends to have a reverse tapered shape as described above. When the resist according to the present invention is a negative type, it tends to have a reverse tapered shape as described above. In the case of the reverse tapered shape, between the metal on the resist pattern and the metal formed on the region where the resist pattern is not formed is distant, so that the former metal can be easily removed.

[0077] The method for manufacturing a pattern substrate according to the present invention comprises the following steps:
forming a resist pattern by the above-described method;
(5b) etching using the resist pattern as a mask; and
(6b) processing the substrate.

The etching can be either dry etching or wet etching, and the etching can be performed a plurality of times. Subsequent to the steps (1) to (4), the steps (5b) and (6b) are carried out. The order of the processes is as described above.

[0078] In addition, the method for manufacturing a pattern substrate according to the present invention comprises the following steps:
forming a resist pattern by the above-described method;
(5c) etching the resist pattern; and
(5d) etching the substrate.

Subsequent to the steps (1) to (4), the steps (5c) and

(6d) are carried out. The order of the steps is as described above.

Here, the combination of the steps (5c) and (5d) is repeated at least twice; and the substrate consists of a laminate of several Si-containing layers, in which at least one Si-containing layer is conductive and at least one Si-containing layer is electrically insulative.

Preferably, the conductive Si-containing layers and electrically insulative Si-containing layers are alternately laminated. Here, the film thickness of the resist film formed from the lithography composition is preferably 0.5 to 200 μm .

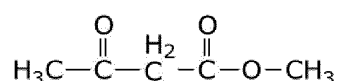
[0079] After that, if necessary, the substrate is further processed to form a device. Known methods can be applied to this further processing. The method for manufacturing a device according to the present invention comprises either of the above-described method, and preferably, a step of forming a wiring on the processed substrate is further comprised. Examples of the device include a semiconductor device, a liquid crystal display device, an organic EL display device, a plasma display device, and a solar cell device. The device is preferably a semiconductor device.

[0080] The present invention is explained below by use of the various examples. The embodiment of the present invention is not limited only to these examples.

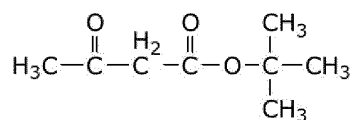
[0081] The components used hereinafter are shown below.

[0082] The components (A) or comparative compounds used are as follows.

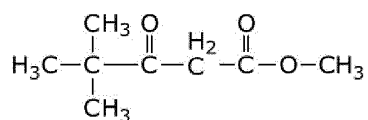
Comparative compound CA: methylacetoacetate (Tokyo Chemical Industry, hereafter referred to as TCI)



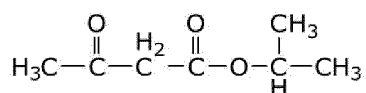
A1: t-butylacetoacetate (TCI)



A2: methyl-4,4-dimethyl-3-oxovalerate (TCI)

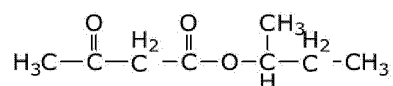


A3: isopropylacetoacetate (TCI)

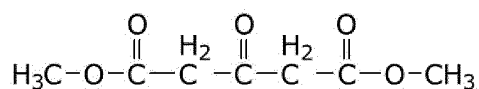


5

A4: s-butylacetoacetate (TCI)

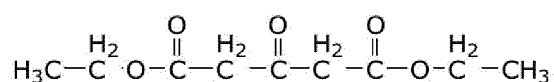


A5: dimethyl-1,3-acetone dicarboxylate (TCI)



10

A6: diethyl-1,3-acetone dicarboxylate (TCI)



[0083] The component (B) used is as follows.

B1: PGMEA

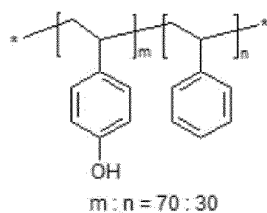
B2: PGME

15

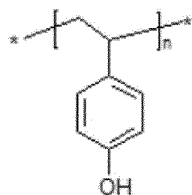
B3: EL

[0084] The component (C) used is as follows.

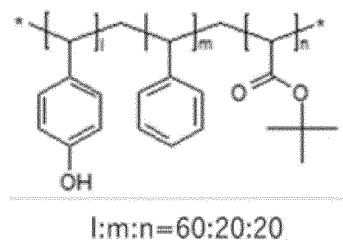
C1-1: CST7030 random copolymer (p-hydroxystyrene (70), styrene (30)), Mw: about 9,700 (Maruzen Petrochemical)



C1-2: VP-3500, p-hydroxystyrene, Mw: about 5,000
(Nippon Soda)

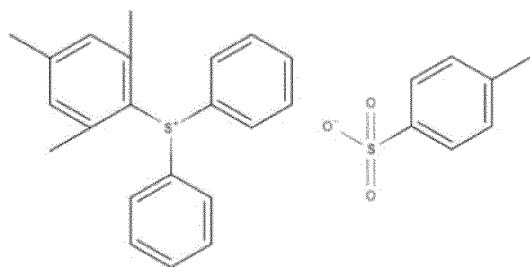


5 C1-3: Poly-TZ-GIJ random copolymer (p-hydroxystyrene
(60), styrene (20), t-butyl acrylate), Mw: about 12,000
(DuPont)

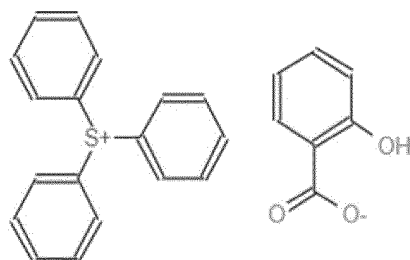


[0085] The component (D) used is as follows.

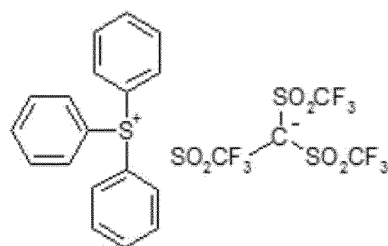
10 D1: WPAG367 (FUJIFILM Wako Pure Chemical)



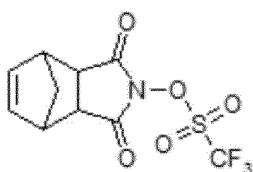
D2: TPS-SA (Toyo Gosei)



D3: TPS-C1 (Heraeus)

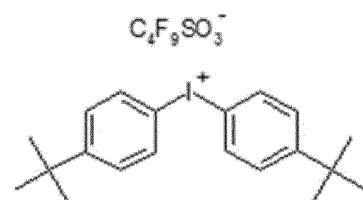


D4: MDT Sensitizer (Heraeus)

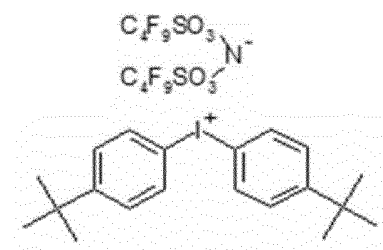


5

D5: Garo IN-K (DSP Gokyo Food & Chemical)



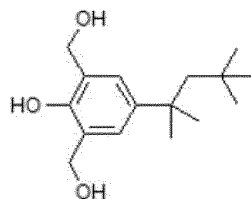
D6: WPI-169 (FUJIFILM Wako Pure Chemical)



10

[0086] The component (E) used is as follows.

E1: DML-POP, Honshu Chemical Industry



[0087] The component (F) used is as follows.

F1: triethanolamine (TCI)

F2: tris[2-(2-methoxyethoxy)ethyl]amine (TCI)

5 [0088] The component (G) used is the surfactant G1 (Megafac R2011, DIC).

[0089] <Preparation of Comparative Example Composition 1>

10 The solvent B1 (65.1 g) and the solvent B2 (27.9 g) are mixed to prepare a B1B2 mixed solvent. To this, 3.710 g of C1-1, 2.474 g of C1-2, 0.577 g of E1, 0.127 g of D1, 0.106 g of D2 and 0.006 g of G1 are added. The solution is mixed at room temperature and it is visually confirmed that the solid components dissolve. Comparative Example Composition 1 is obtained.

15 [0090] <Preparations of Example Compositions 1 to 8 and Comparative Example Compositions 2 to 3>

20 Example Compositions 1 to 8 and Comparative Example Compositions 2 to 3 are prepared in the same manner as in the preparation example of Comparative Example Composition 1 except that the components are changed as shown in Tables 1 and 2 below.

[Table 1]

Table 1: Each addition amount in the total mass 100g

		Comparative Example Composition 1	Example Composition 1	Example Composition 2	Example Composition 3	Comparative Example Composition 2	Comparative Example Composition 3
Component (A) (g)	CA	—	—	—	—	2.373	3.545
	A1	—	2.068	2.879	50.236	—	—
Component (B) (g)	B1	65.1	65.1	65.1	29.935	65.1	65.1
	B2	27.9	27.9	27.9	12.829	27.9	27.9
Component (C) (g)	C1-1	3.71	2.614	2.184	3.71	2.452	1.832
	C1-2	2.474	1.743	1.456	2.474	1.635	1.221
Component (D) (g)	D1	0.127	0.089	0.075	0.127	0.084	0.063
	D2	0.106	0.075	0.063	0.106	0.07	0.053
Component (E) (g)	E1	0.577	0.406	0.339	0.577	0.381	0.285
Component (G) (g)	G1	0.006	0.006	0.006	0.006	0.006	0.006

[Table 2]

Table 2: Each addition amount in the total mass 100g

		Example Composition 4	Example Composition 5	Example Composition 6	Example Composition 7	Example Composition 8
Component (A) (g)	A2	2.879	—	—	—	—
	A3	—	2.723	—	—	—
	A4	—	—	2.879	—	—
	A5	—	—	—	3.044	—
	A6	—	—	—	—	3.303
Component (B) (g)	B1	65.1	65.1	65.1	65.1	65.1
	B2	27.9	27.9	27.9	27.9	27.9
Component (C) (g)	C1-1	2.184	2.267	2.184	2.097	1.96
	C1-2	1.456	1.511	1.456	1.398	1.307
Component (D) (g)	D1	0.075	0.077	0.075	0.072	0.067
	D2	0.063	0.065	0.063	0.06	0.056
Component (E) (g)	E1	0.339	0.352	0.339	0.326	0.305
Component (G) (g)	G1	0.006	0.006	0.006	0.006	0.006

[0091] <Resist Pattern Forming Example 1>

5

A BARC film of 45 nm is formed by subjecting AZ KrF-17B (Merck Performance Materials, hereinafter referred to as MPM) to spin coating on the surface of a silicon substrate (SUMCO, 8 inches) and soft baking at 180°C for 60 seconds. On the film, a resist film having a film thickness of 235 nm is formed by subjecting each Example Composition to spin coating on the same substrate and soft baking at 110°C for 60 seconds. In accordance with this configuration, the light reflectance of the KrF (248 nm) is set to become 7%. The obtained

10

substrate is exposed with KrF using an exposure apparatus (Canon, FPA-3000EX5). As the exposure mask, a mask having a line : space = 1 : 1 and spaces of 1.0 μm continuing multiple times, which are gradually decreasing as shown below is used:

1000 nm, 900 nm, 800 nm, 700 nm, 600 nm, 500 nm, 400 nm, 300 nm, 280 nm, 260 nm, 240 nm, 220 nm, 200 nm, 190 nm, 180 nm, 170 nm, 160 nm, 150 nm, 140 nm, 130 nm, 120 nm, 110 nm, 100 nm.

The substrate is subjected to post-exposure baking (PEB) at 100°C for 60 seconds. Then, the resist film is subjected to paddle development for 60 seconds with a 2.38% aqueous solution of tetramethylammonium hydroxide (TMAH). In the state that the paddle developer is paddled on the substrate, pure water is started to be flown onto the substrate, the paddle developer is replaced with pure water while rotating, and spin drying is performed at 2000 rpm.

[0092] <Standing Wave Reduction Evaluation 1>

The reduction of standing wave is evaluated. The pattern in which the space of the resist pattern formed in the above Resist Pattern Forming Example 1 corresponds to 150 nm is observed. A cut piece is prepared from the substrate and observed by SEM (SU8230, Hitachi High-Technologies). The internode distance defined above is measured (Offline CD Measurement Software Version 6.00, Hitachi High-Technologies). The standing wave index is calculated by dividing the internode distance by the desired pattern width. Evaluation is performed according to the following evaluation criteria.

A: Standing wave index is 0% or more and 5% or less.

B: Standing wave index is more than 5% and less than 10%.

C: Standing wave index is 10% or more.

[0093] <Minimum Size Evaluation 1>

The minimum size of the resist pattern formed in the above Resist Pattern Forming Example 1 is evaluated. It is checked if any pattern collapse is not occurred starting from the large pattern, and the observation target is gradually transferred to the smaller pattern. The pattern immediately before the pattern collapse can be confirmed (the pattern that has not been collapsed) is taken the minimum size. The results obtained are as shown in Tables 3 and 4.

[Table 3]

Table 3

	Comparative Example Composition 1	Example Composition 1	Example Composition 2	Example Composition 3	Comparative Example Composition 2	Comparative Example Composition 3
Standing Wave Reduction	C	B	A	A	C	C
Minimum Size (nm)	150	150	140	140	150	150

[Table 4]

Table 4

	Example Composition 4	Example Composition 5	Example Composition 6	Example Composition 7	Example Composition 8
Standing Wave Reduction	A	A	A	A	A
Minimum Size (nm)	140	140	140	140	140

As shown in Comparative Composition 1, tests are conducted under the conditions that standing wave cannot be completely prevented even when BARC is present.

[0094] <Developer Dissolution (ADR) Evaluation>

Example Compositions 1, 5 and 7 are each applied onto a silicon substrate and subjected to soft baking at 110°C for 60 seconds to prepare a film so as to have a thickness of 235 nm. After that, the resist film is baked at 100°C for 60 seconds without exposure, and the resist film is subjected to paddle development with a 2.38% aqueous solution of tetramethylammonium hydroxide (TMAH), and the time until the film dissolves is visually measured. The evaluation results of Example Compositions 1, 5 and 7 are 50 seconds, 33 seconds and 51 seconds, respectively.

[0095] <Preparations of Example Composition 9 and Comparative Example Composition 4>

5 Example Composition 9 and Comparative Example Composition 4 are prepared in the same manner as in the preparation of Comparative Composition 1 except that the components are changed as shown in Table 5 below.

[Table 5]

Table 5: Each addition amount in the total mass 100g

		Comparative Example Composition 4	Example Composition 9
Component (A) (g)	A1	—	7.876
Component (B) (g)	B1	81.23	81.23
Component (C) (g)	C1-1	8.578	4.979
	C1-2	8.578	4.979
Component (D) (g)	D3	0.29	0.166
	D4	0.06	0.034
Component (E) (g)	E1	1.188	0.69
Component (F) (g)	F1	0.03	0.018
	F2	0.03	0.018
Component (G) (g)	G1	0.017	0.01

10 [0096] <Resist Pattern Forming Example 2>

A resist pattern is formed in the same manner as in the above Resist Pattern Forming Example 1 except that the surface of a silicon substrate (SUMCO, 8 inches) is first treated with a 1,1,1,3,3,3-hexamethyl disilazane solution at 90°C for 60 seconds, that no BARC film is
15 formed and the film thickness of the resist film to be formed is made to be 800 nm, and that in accordance with this configuration, the light reflectance of KrF (248 nm) is set to become 53%.

20 [0097] <Standing Wave Reduction Evaluation 2>

For the resist pattern formed in the Resist Pattern Forming Example 2, the standing wave reduction is evaluated in the same manner as the above Standing

Wave Reduction Evaluation 1 except that the pattern corresponding to 300 nm is observed.

[0098] <Minimum Size Evaluation 2>

5 For the resist pattern formed in the Resist Pattern Forming Example 2, the minimum size is evaluated in the same manner as in the above Minimum Size Evaluation 1. The results obtained are as shown in Table 6.

[Table 6]

Table 6

	Comparative Example Composition 4	Example Composition 9
Standing Wave Reduction	C	B
Minimum Size (nm)	280	240

10

[0099] <Preparation of Comparative Example Composition 5>

The solvent B2 (54.53 g) and the solvent B3 (23.37 g) are mixed to prepare a B2B3 mixed solvent. To this, 21.539 g of C1-3, 0.052 g of D2, 0.065 g of D3, 15 0.226 g of D5, 0.129 g of D6, 0.057 g of F2 and 0.033 g of G1 are added. The solution is mixed at room temperature and it is visually confirmed that the solid components dissolve. Comparative Example Composition 5 is obtained.

20 [0100] <Preparation of Example Composition 10>

Example Composition 10 is prepared in the same manner as the preparation of Comparative Example Composition 5 except that the components are changed as shown in the table below.

25 [Table 7]

Table 7: Each addition amount in the total mass 100g

		Comparative Example Composition 5	Example Composition 10
Component (A) (g)	A1	–	13.951
Component (B) (g)	B2	54.53	20.1
	B3	23.37	46.9
Component (C) (g)	C1–3	21.539	18.565
Component (D) (g)	D2	0.052	0.045
	D3	0.065	0.056
	D5	0.226	0.195
	D6	0.129	0.111
Component (F) (g)	F2	0.057	0.049
Component (g)	G1	0.033	0.028

[0101] <Resist Pattern Forming Example 3>

A resist pattern is formed in the same manner as
 in the above Resist Pattern Forming Example 1 except
 5 that the surface of a silicon substrate (SUMCO, 8 inches)
 is first treated with a 1,1,1,3,3,3-hexamethyl disilazane
 solution at 90°C for 60 seconds, that no BARC film is
 formed and the film thickness of the resist film to be
 10 formed is made to be 800 nm, that in accordance with
 this configuration, the light reflectance of KrF (248 nm)
 is set to become 53%, and that post-exposure baking is
 performed at 110°C for 60 seconds.

[0102] <Standing Wave Reduction Evaluation 3>

For the resist pattern formed in the Resist Pattern
 15 Forming Example 3, the standing wave reduction is
 evaluated in the same manner as the above Standing
 Wave Reduction Evaluation 1 except that the pattern
 corresponding to 400 nm is observed. The results
 obtained are as shown in Table 8.

20 [0103] <Minimum Size Evaluation 3>

For the resist pattern formed in the Resist Pattern
 Forming Example 3, the minimum size is evaluated in

the same manner as in the above Minimum Size Evaluation 1. The results obtained are as shown in Table 8.

[Table 8]

Table 8

	Comparative Example Composition 5	Example Composition 10
Standing Wave Reduction	C	A
Minimum Size (nm)	380	340

5

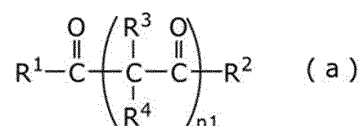
[Explanation of symbols]

- [0104] 1. substrate
2. resist pattern affected by standing wave
3. antinode
4. node
5. internode distance
11. substrate
12. resist pattern not affected by standing wave.

10

Patent Claims

1. A method for using a composition comprising a carboxylic acid ester (A) to reduce standing wave in a lithography process, wherein the carboxylic acid ester (A) is represented by the formula (a):



where

R^1 is C_{1-10} alkyl or $-OR^{1'}$,

R^2 is $-OR^{2'}$,

$R^{1'}$ and $R^{2'}$ are each independently C_{1-20} hydrocarbon,

R^3 and R^4 are each independently H or C_{1-10} alkyl,

R^1 and R^3 or R^4 , or R^2 and R^3 or R^4 can be bonded to form a saturated or unsaturated hydrocarbon ring, and

$n1$ is 1 or 2,

provided that when $n1$ is 1, at least one of R^1 or $R^{1'}$, and $R^{2'}$ is C_{3-20} hydrocarbon.

2. The method according to claim 1, wherein the composition is used for being applied above a substrate to form a film:

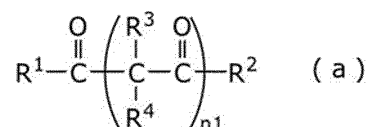
preferably, no bottom anti-reflective coating is formed above the substrate.

3. The method according to claim 1 or 2, wherein the composition comprises a solvent (B):
preferably, the composition comprises a film-forming component (C),

preferably, the content of the carboxylic acid ester (A) is 1.0 to 200 mass %, based on the solvent (B), or

preferably, the content of the carboxylic acid ester (A) is 10 to 3,000 mass %, based on the film-forming component (C).

4. A lithography composition comprising a carboxylic acid ester (A) and a solvent (B), wherein the carboxylic acid ester (A) is represented by the formula (a):



where

R^1 is C_{1-10} alkyl or $-OR^{1'}$,

R^2 is $-OR^{2'}$,

$R^{1'}$ and $R^{2'}$ are each independently C_{1-20} hydrocarbon,

R^3 and R^4 are each independently H or C_{1-10} alkyl,

R^1 and R^3 or R^4 , or R^2 and R^3 or R^4 can be bonded to form a saturated or unsaturated hydrocarbon ring, and

$n1$ is 1 or 2,

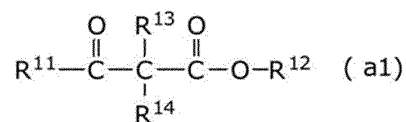
provided that when $n1$ is 1, at least one of R^1 or $R^{1'}$, and $R^{2'}$ is C_{3-20} hydrocarbon,

preferably, the solvent (B) comprises an organic solvent (B1);

or

preferably, the organic solvent (B1) comprises a hydrocarbon solvent, an ether solvent, an ester solvent, an alcohol solvent, a ketone solvent, or a mixture of any of these.

5. The lithography composition according to claim 4, wherein the carboxylic acid ester (A) is represented by the formula (a1):



where

R^{11} is C_{1-5} alkyl,

R^{12} is C_{3-20} hydrocarbon, and

R^{13} and R^{14} are each independently H or C_{1-5} alkyl.

6. The lithography composition according to claim 4 or 5,

further comprising a film-forming component (C):
preferably, the lithography composition comprises an acid generator (D);
preferably, the lithography composition comprises a crosslinking agent (E);
preferably, the lithography composition comprises a basic compound (F);
preferably, the lithography composition comprises a surfactant (G);
preferably, the film-forming component (C) comprises polymer (C1); or
preferably, the mass average molecular weight of the polymer (C1) is 500 to 100,000.

7. The lithography composition according to one or more of claims 4 to 6, further comprising an additive (H):
preferably, the additive (H) comprises a plasticizer, a dye, a contrast enhancer, an acid, a radical generator, a substrate adhesion enhancer, an antifoaming agent, or a mixture of any of these.

8. The lithography composition according to one or more of claims 4 to 7, wherein the content of the carboxylic acid ester (A) is 1.0 to 200 mass %, based on the solvent (B):
preferably, the content of the carboxylic acid ester (A) is 10 to 3,000 mass %, based on the film-forming component (C);
preferably, the content of the solvent (B) is 10 to 98 mass %, based on the lithography composition;
preferably, the content of the film-forming component (C) is 2 to 40 mass %, based on the lithography composition;
preferably, the content of the acid generator (D) is 0.5 to 20 mass %, based on the film-forming component (C);
preferably, the content of the crosslinking agent (E) is 3 to 30 mass %, based on the film-forming component (C);
preferably, the content of the basic compound (F) is 0.01 to 1.0 mass %, based on the film-forming component (C); or

preferably, the content of the surfactant (G) is 0.05 to 0.5 mass %, based on the film-forming component (C).

9. The lithography composition according to one or more of claims 4 to 8, which satisfies $bp_A > bp_B$ and $vp_{CA} < vp_{CB}$ assuming that the boiling points of the carboxylic acid ester (A) and the solvent (B) are respectively bp_A and bp_B , and that the saturated vapor pressures at 25°C and 1 atm are respectively vp_{CA} and vp_{CB} .

10. The lithography composition according to one or more of claims 4 to 9, which is a lithography film-forming composition: preferably, the lithography composition is a resist composition; preferably, the lithography composition is a negative type resist composition; or preferably, the lithography composition is a chemically amplified type resist composition.

11. A method for manufacturing a film comprising the following steps:

- (1) applying the lithography composition according to one or more of claims 4 to 10 above a substrate; and
- (2) forming a film from the lithography composition under reduced pressure and/or heating:
preferably, no anti-reflective coating is formed above the substrate before applying the lithography composition.

12. A method for manufacturing a resist pattern comprising the following steps:

- forming a film from the lithography composition by the method according to claim 11;
- (3) exposing the film with radiation; and
 - (4) developing the film to form a resist pattern,
- wherein the lithography composition is a resist composition: preferably, light having a wavelength of 13.5 to 365 nm is used for the exposure.

13. A method for manufacturing a metal pattern comprising the following steps:
forming a resist pattern by the method according to claim 12;
(5a) forming a metal layer on the resist pattern; and
(6a) removing the remaining resist pattern and the metal layer thereon.

14. A method for manufacturing a pattern substrate comprising the following steps:
forming a resist pattern by the method according to claim 12;
(5b) etching using the resist pattern as a mask; and
(6b) processing the substrate.

15. A method for manufacturing a pattern substrate comprising the following steps:
forming a resist pattern by the method according to claim 12;
(5c) etching the resist pattern; and
(5d) etching the substrate,
wherein the combination of the steps (5c) and (5d) is repeated at least twice; and
the substrate consists of a laminate of several Si-containing layers, in which at least one Si-containing layer is conductive and at least one Si-containing layer is electrically insulative: preferably, the conductive Si-containing layers and electrically insulative Si-containing layers are alternately laminated; or preferably, the resist film formed from the lithography composition has a film thickness of 0.5 to 200 μm .

16. A method for manufacturing a device comprising the method according to one or more of claims 11 to 15: preferably, a step of forming a wiring on the processed substrate is further comprised; or preferably, the device is a semiconductor device.