

Specific examples of the alkyl alcohol amine include diethanolamine, triethanolamine, diisopropanolamine, triisopropanolamine, di-n-octanolamine, tri-n-octanolamine, stearyldiethanolamine and lauryldiethanolamine.

Examples of the cyclic amine include heterocyclic compounds containing a nitrogen atom as a hetero atom. The heterocyclic compound may be a monocyclic compound (aliphatic monocyclic amine) or a polycyclic compound (aliphatic polycyclic amine).

Specific examples of the aliphatic monocyclic amine include piperidine and piperazine.

The aliphatic polycyclic amine preferably has 6 to 10 carbon atoms, and specific examples include 1,5-diazabicyclo[4.3.0]-5-nonene, 1,8-diazabicyclo[5.4.0]-7-undecene, hexamethylenetetramine and 1,4-diazabicyclo[2.2.2]octane.

Examples of other aliphatic amines include tris(2-methoxymethoxyethyl)amine, tris{2-(2-methoxyethoxy)ethyl}amine, tris{2-(2-methoxyethoxymethoxy)ethyl}amine, tris{2-(1-methoxyethoxy)ethyl}amine, tris{2-(1-ethoxyethoxy)ethyl}amine, tris{2-(1-ethoxypropoxy)ethyl}amine and tris[2-{2-(2-hydroxyethoxy)ethoxy}ethyl]amine.

Examples of the aromatic amine include aniline, pyridine, 4-dimethylaminopyridine, pyrrole, indole, pyrazole, imidazole and derivatives thereof, diphenylamine, triphenylamine, tribenzylamine, 2,6-diisopropylaniline and N-tert-butoxycarbonyl pyrrolidine.

As the component (D), any of the above compounds may be used alone, or two or more different compounds may be used in combination.

The component (D) is typically used in an amount within a range from 0.01 to 5.0 parts by weight, relative to 100 parts by weight of the combination of the component (A) and the component (C) (or relative to 100 parts by weight of the component (A) in those cases where the composition does not include the component (C)). By ensuring that the amount of the component (D) is within the aforementioned range, the shape of the resist pattern and the post exposure stability of the latent image formed by the pattern-wise exposure of the resist layer are improved.

Furthermore, in the resist composition of the present invention, for the purposes of preventing any deterioration in sensitivity, and improving the resist pattern shape and the post exposure stability of the latent image formed by the pattern-wise exposure of the resist layer, at least one compound (E) (hereinafter referred to as "component (E)") selected from the group consisting of organic carboxylic acids, and phosphorus oxo acids and derivatives thereof may also be added.

Examples of the organic carboxylic acids include acetic acid, malonic acid, citric acid, malic acid, succinic acid, benzoic acid and salicylic acid.

Examples of the phosphorus oxo acids include phosphoric acid, phosphonic acid and phosphinic acid. Among these, phosphonic acid is particularly desirable.

Examples of the phosphorus oxo acid derivatives include esters in which a hydrogen atom within an aforementioned oxo acid is substituted with a hydrocarbon group. Examples of the hydrocarbon group include alkyl groups of 1 to 5 carbon atoms and aryl groups of 6 to 15 carbon atoms.

Examples of phosphoric acid derivatives include phosphate esters such as di-n-butyl phosphate and diphenyl phosphate.

Examples of phosphonic acid derivatives include phosphonate esters such as dimethyl phosphonate, di-n-butyl phosphonate, phenylphosphonic acid, diphenyl phosphonate and dibenzyl phosphonate.

Examples of phosphinic acid derivatives phosphinic acid esters such as phenylphosphinic acid.

As the component (E), salicylic acid is particularly preferred.

As the component (E), one compound may be used alone, or two or more different compounds may be used in combination.

The component (E) is typically used in an amount within a range from 0.01 to 5.0 parts by weight relative to 100 parts by weight of the combination of the component (A) and the component (C) (or relative to 100 parts by weight of the component (A) in those cases where the composition does not include the component (C)).

If desired, miscible additives may also be added to the resist composition of the present invention. Examples of such miscible additives include additive resins for improving the performance of the resist film, surfactants for improving the applicability, dissolution inhibitors, plasticizers, stabilizers, colorants, halation prevention agents, and dyes.

The resist composition of the present invention can be prepared by dissolving the materials for the resist composition in an organic solvent (hereinafter frequently referred to as "component (S)").

The component (S) may be any organic solvent which can dissolve each of the components used to give a uniform solution, and one or more types of organic solvent may be selected appropriately from those solvents that have been conventionally known as solvents for a chemically amplified resists.

Examples include lactones such as γ -butyrolactone; ketones such as acetone, methyl ethyl ketone, cyclohexanone, methyl-n-pentyl ketone, methyl isopentyl ketone and 2-heptanone;

polyhydric alcohols such as ethylene glycol, diethylene glycol, propylene glycol and dipropylene glycol;

polyhydric alcohol derivatives, including compounds having an ester bond such as ethylene glycol monoacetate, diethylene glycol monoacetate, propylene glycol monoacetate and dipropylene glycol monoacetate, and compounds having an ether bond, such as a monoalkyl ether (such as a monomethyl ether, monoethyl ether, monopropyl ether or monobutyl ether) or a monophenyl ether of any of these polyhydric alcohols or compounds having an ester bond [among these derivatives, propylene glycol monomethyl ether acetate (PGMEA) and propylene glycol monomethyl ether (PGME) are preferred];

cyclic ethers such as dioxane;

esters such as methyl lactate, ethyl lactate (EL), methyl acetate, ethyl acetate, butyl acetate, methyl pyruvate, ethyl pyruvate, methyl methoxypropionate and ethyl ethoxypropionate; and

aromatic organic solvents such as anisole, ethyl benzyl ether, cresyl methyl ether, diphenyl ether, dibenzyl ether, phenetole, butyl phenyl ether, ethylbenzene, diethylbenzene, pentylbenzene, isopropylbenzene, toluene, xylene, cymene and mesitylene.

These organic solvents may be used individually, or as a mixed solvent containing two or more solvents.

Among the above solvents, propylene glycol monomethyl ether acetate (PGMEA), propylene glycol monomethyl ether (PGME) and ethyl lactate (EL) are preferred.

Further, among the mixed solvents, a mixed solvent obtained by mixing PGMEA with a polar solvent is preferable. The mixing ratio (weight ratio) of the mixed solvent may be determined as appropriate, with due consideration of the compatibility of the PGMEA with the polar solvent, but is preferably within a range from 1:9 to 9:1, and more preferably from 2:8 to 8:2. For example, when EL is mixed as the polar