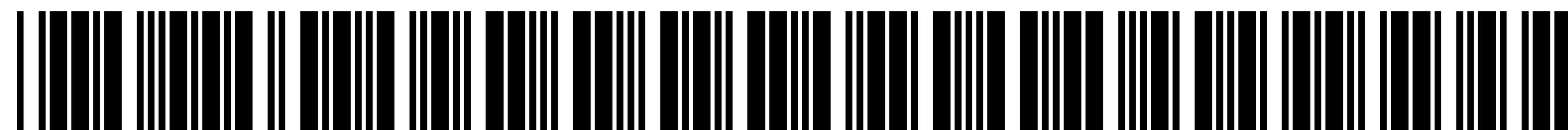
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(54) **METHOD FOR RELEASING RESIST**

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(57) **ABSTRACT**

In the resist stripping method of the present invention, a wiring substrate having a remaining resist layer is brought into contact with a resist stripping composition in an atmosphere containing oxygen in a proportion of 2% by volume or less. Preferably, the resist is removed after pretreating the remaining resist layer with hydrogen peroxide. A resist stripping composition comprising an amine compound, a solvent, a strong alkali, and water is preferably used in the resist stripping method of the present invention.

METHOD FOR RELEASING RESIST

TECHNICAL FIELD

[0001] The present invention relates to a composition and a method for removing resists for use in the manufacture of semiconductor integrated circuits, liquid crystal panels, organic EL panels, printed circuit boards, etc.

BACKGROUND ART

[0002] Photoresists have been widely used in the lithographic production of integrated circuits such as IC and LSI, display devices such as LCD and EL devices, printed circuit boards, micro machines, DNA chips, and micro plants.

[0003] A solution containing an organic alkali and a water soluble solvent has been conventionally used as the resist stripping composition. Particularly, amine compounds have been frequently used as the organic alkali, and as the resist stripping composition, for example, a non-aqueous solution containing an alkanolamine and dimethyl sulfoxide; an aqueous solution containing an alkanolamine, a water-soluble solvent and a sugar alcohol; an aqueous solution containing an alkanolamine, hydroxylamine and catechol have been used. These alkaline resist stripping compositions are quite effective for removing resists comprising a phenolic hydroxyl-containing compound and an ester linkage-containing compound.

[0004] These resist stripping compositions have been used for removing mainly resist on non-copper based substrate such as aluminum and an aluminum alloy at room temperature to 100° C.

[0005] Recently, a low resistance copper comes to be used as a wiring material, particularly, increasingly used as a wiring material for semiconductors represented by LSI. Simultaneously, a low dielectric layer comes to be used as an insulating material. In conventional processes, the resist is developed, subjected to dry etching and ashing, and then removed. However, the ashing process is liable to change surface properties of the low dielectric layer to detract from the function of a circuit. Therefore, a process without the ashing process is demanded. Since a dry-etched resist is considerably changed in its property, the resist cannot be removed sufficiently by known resist stripping compositions containing an amine compound as the effective ingredient. Further, since the resist stripping composition containing an amine compound produces a copper-amine complex, a copper wiring is easily corroded thereby.

DISCLOSURE OF INVENTION

[0006] An object of the present invention is to provide a method for removing resists by using a resist stripping composition containing an amine compound without the corrosion of copper, particularly, a copper wiring. Another object of the present invention is to provide a resist stripping composition containing an amine compound for use in the method for removing resists.

[0007] As a result of extensive study on the removal of resists on a copper wiring substrate, the inventors have found that a composition comprising an amine compound, a solvent, a strong alkali and water can remove the resists without the corrosion of copper or a copper alloy.

[0008] Furthermore, the inventors have extensively study on optimum conditions for removing the resist without the corrosion of copper. As a result thereof, contrary to the general acknowledgement that an amine compound corrodes copper, the inventors have found that oxygen dissolved in the resist stripping composition oxidizes copper, and the oxidized copper is transformed into a soluble copper-amine complex to promote the corrosion of copper, that is, it has been found that the oxygen dissolved in the resist stripping composition is a main cause of the corrosion of copper.

[0009] Thus, the present invention provide a resist stripping method comprising a step of bringing a wiring substrate having a remaining resist layer after etching into contact with a resist stripping composition in an atmosphere containing oxygen in a proportion of 2% by volume or less. In a preferred embodiment, the contact with the resist stripping composition is performed after pretreating the remaining resist layer with hydrogen peroxide.

[0010] Also, the present invention provides a resist stripping composition comprising an amine compound, a solvent, a strong alkali and water, which is usable in the above resist stripping method.

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] The resist stripping composition comprises an amine compound, a solvent, a strong alkali (optional component) and water.

[0012] Examples of the amine compounds include ammonia, monoalkylamines, dialkylamines, trialkylamines, alkanolamines, polyamines, hydroxylamine compounds and cyclic amines.

[0013] The monoalkylamines may include methylamine, ethylamine, n-propylamine, isopropylamine, n-butylamine, sec-butylamine, isobutylamine, tert-butylamine, pentylamine, 2-aminopentane, 3-aminopentane, 1-amino- methylbutane, 2-amino-2-methylbutane, 3-amino-2-methylbutane, 4-amino-2-methylbutane, hexylamine, 5-amino-2-methylpentane, heptylamine, octylamine, nonylamine, decylamine, undecylamine, dodecylamine, tridecylamine, tetradecylamine, pentadecylamine, hexadecylamine, heptadecylamine and octadecylamine; the dialkylamines may include dimethylamine, diethylamine, dipropylamine, diisopropylamine, di-n-butylamine, diisobutylamine, di-sec-butylamine, di-tert-butylamine, dipentylamine, dihexylamine, diheptylamine, dioctylamine, dinonylamine, didecylamine, methylethylamine, methypropylamine, methylisopropylamine, methyl-n-butylamine, methylisobutylamine, methyl-sec-butylamine, methyl-tert-butylamine, methylamylamine, methylisoamylamine, ethylpropylamine, ethylisopropylamine, ethyl-n-butylamine, ethylisobutylamine, ethyl-sec-butylamine, ethyl-tert-butylamine, ethylisoamylamine, propyl-n-butylamine and propylisobutylamine; and the trialkylamines may include trimethylamine, triethylamine, tripropylamine, tributylamine, tripentylamine, dimethylethylamine, methyldiethylamine and methyldipropylamine.

[0014] The alkanolamines may include ethanolamine, 1-amino-2-propanol, N-(aminoethyl)ethanolamine, N-methylethanolamine, N-ethylethanolamine, N-propylethanolamine, N-butylethanolamine, diethanolamine, isoprop anola-

mine, N-methylisopropanolamine, N-ethylisopropanolamine, N-propylisopropanolamine, 2-aminopropane- 1-ol, N-methyl-2-aminopropane-1-ol, N-ethyl-2-aminopropane-1-ol, 1-aminopropane-3-ol, N-methyl-1-aminopropane-3-ol, N-ethyl-1-aminopropane-3-ol, 1-aminobutane-2-ol, N-methyl-1-aminobutane-2-ol, N-ethyl-1-aminobutane-2-ol, 2-aminobutane-1-ol, N-methyl-2-aminobutane-1-ol, N-ethyl-2-aminobutane-1-ol, 3-aminobutane-1-ol, N-methyl-3-aminobutane-1-ol, N-ethyl-3-aminobutane-1-ol, 1-aminobutane-4-ol, N-methyl-1-aminobutane-4-ol, N-ethyl-1-aminobutane-4-ol, 1-amino-2-methylpropane-2-ol, 2-amino-2-methylpropane-1-ol, 1-aminopentane-4-ol, 2-amino-4-methylpentane-1-ol, 2-aminohexane- 1-ol, 3-aminoheptane-4-ol, 1-aminooctane-2-ol, 5-aminooctane-4-ol, 1-aminopropane-2,3-diol, 2-aminopropane -1,3-diol, tris(oxymethyl)aminomethane, 1,2-diaminopropane-3-ol, 1,3-diaminopropane-2-ol and 2-(2-aminoethoxy)ethanol.

[0015] The polyamines may include ethylenediamine, propylenediamine, trimethylenediamine, tetramethylenediamine, 1,3-diaminobutane, 2,3-diaminobutane, pentamethylenediamine, 2,4-diaminopentane, hexamethylenediamine, heptamethylenediamine, octamethylenediamine, nonamethylenediamine, N-methylethylenediamine, N,N-dimethylethylenediamine, trimethylethylenediamine, N-ethylethylenediamine, N,N-diethylethylenediamine, triethylethylenediamine, 1,2,3-triaminopropane, hydrazine, tris(2-aminoethyl)amine, tetra(aminomethyl)methane, diethylenetriamine, triethylenetetramine, tetraethylenepentamine, heptaethyleneoctamine, nonaethylenedecamine, diazabicycloundecene, hydrazine, dimethylhydrazine, methylhydrazine and hydroxyethylhydrazine.

[0016] The hydroxylamine compounds may include hydroxylamine, N-methylhydroxylamine, N-ethylhydroxylamine and N,N-diethylhydroxylamine.

[0017] The cyclic amines may include pyrrole, 2-methylpyrrole, 3-methylpyrrole, 2-ethylpyrrole, 3-ethylpyrrole, 2,3-dimethylpyrrole, 2,4-dimethylpyrrole, 3,4-dimethylpyrrole, 2,3,4-trimethylpyrrole, 2,3,5-trimethylpyrrole, 2-pyrroline, 3-pyrroline, pyrrolidine, 2-methylpyrrolidine, 3-methylpyrrolidine, pyrazole, imidazole, 1,2,3-trizaole, 1,2,3,4-tetrazole, piperidine, 2-pipecoline, 3-pipecoline, 4-pipecoline, 2,4-lupetidine, 2,6-lupetidine, 3,5-lupetidine, piperazine, 2-methylpiperazine, 2,5-dimethylpiperazine, 2,6-dimethylpiperazine and morpholine.

[0018] Of the amine compounds recited above, preferred is at least one compound selected from the group consisting of ethanolamine, 1-amino-2-propanol, N-(aminoethyl)ethanolamine, N-methylethanolamine, N-ethylethanolamine, diethanolamine, isopropanolamine, 2- (2-aminoethoxy)ethanol, ethylenediamine, propanediamine, butylenediamine, diethylenetriamine, piperazine, morpholine, triethylenetetramine, tetraethylenepentamine and pentaethylenehexamine.

[0019] The strong alkali is preferably at least one compound selected from the group consisting of tetramethylammonium hydroxide, tetraethylammonium hydroxide, tetrapropylammonium hydroxide, tetrabutylammonium hydroxide, choline hydroxide and acetylcholine hydroxide, with tetramethylammonium hydroxide and choline hydroxide being more preferred.

[0020] The solvent is preferably miscible with the amine compound, and examples thereof include ether solvents such as ethylene glycol, ethylene glycol monoethyl ether, ethylene glycol monobutyl ether, diethylene glycol monomethyl ether, diethylene glycol monoethyl ether, diethylene glycol monobutyl ether, propylene glycol monomethyl ether, propylene glycol monoethyl ether, propylene glycol monobutyl ether, dipropylene glycol monomethyl ether, dipropylene glycol monoethyl ether, dipropylene glycol monobutyl ether, diethylene glycol dimethyl ether and dipropylene glycol dimethyl ether; amide solvents such as formamide, monomethylformamide, dimethylformamide, monoethylformamide, diethylformamide, acetamide, monomethylacetamide, dimethylacetamide, monoethylacetamide, diethylacetamide, N-metylpyrrolidone and N-ethylpyrrolidone; alcohol solvents such as methyl alcohol, ethyl alcohol, isopropanol, ethylene glycol, and propylene glycol; sulfoxide solvents such as dimethyl sulfoxide; sulfone solvents such as dimethyl sulfone, diethyl sulfone, bis(2-hydroxysulfone) and tetramethylene sulfone; imidazolidinone solvents such as 1,3-dimethyl-2-imidazolidinone, 1,3-diethyl-2-imidazolidinone, and 1,3-diisopropyl-2-imidazolidinone; and lactone solvents such as γ-butyrolactone and δ-valerolactone.

[0021] Of the above solvents, preferred are dimethyl sulfoxide, N,N-dimethylformamide, N,N-dimethylacetamide, N-methylpyrrolidone, diethylene glycol monomethyl ether, diethylene glycol monobutyl ether, dipropylene glycol monomethyl ether, dipropylene glycol monobutyl ether and propylene glycol because of their easy availability and easy handling properties due to high boiling points. Also, the above amine compounds are usable as the solvents.

[0022] To remove the resists without the corrosion of copper wiring, the resist stripping composition preferably contains 5 to 95% by weight of the amine compound, 3 to 85% by weight of the solvent, 0.01 to 5% by weight of the strong alkali, and 1 to 25% by weight of water; more preferably contains 10 to 40% by weight of the amine compound, 50 to 80% by weight of the solvent, 0.1 to 3% by weight of the strong alkali, and 5 to 20% by weight of water. The resist stripping composition of the present invention may contain a conventional additive such as a surfactant and an anti-corrosion agent including sorbitol and catechol in an amount not adversely affecting the effect of the invention.

[0023] The resist stripping composition may be produced by a conventionally known method without any specific limitation.

[0024] In the present invention, the resist removal is carried out by bringing the remaining resist, after etching and preferably before ashing, into contact with the resist stripping composition comprising the amine compound, the solvent, the strong alkali (optional component), and water at 20 to 60° C. for 1 to 30 min. The contact operation is generally performed by immersing the substrate having the remaining resists into the resist stripping composition.

[0025] For example, phenolic hydroxyl-containing resists widely used change their surface properties by dry etching process. Known resist stripping compositions remove resists by utilizing the salt formation between the amine compound and the phenolic hydroxyl group and the addition reaction of the amine compound to the carbonyl group formed by oxidation, however, less effective for removing resists having their properties changed significantly. In such case, the use of a resist stripping composition containing a strong

alkali enhances the ability of forming the salts with the phenolic hydroxyl group and the ability of removing halogen generated in the dry etching process, and also adds the function of hydrolysis.

[0026] As mentioned above, the oxygen dissolved in the resist stripping composition is a main cause of the corrosion of copper and a copper alloy. The corrosion action becomes remarkable at alkali contents (amine compound +strong alkali) of 3% or more and at high oxygen concentrations of the atmosphere for the resist removal operation. Accordingly, in the present invention, resists are removed in an atmosphere having an oxygen concentration of 2% by volume or less, preferably 1% by volume or less to effectively prevent the corrosion of copper and a copper alloy. The low-oxygen atmosphere is achieved by using nitrogen, argon or hydrogen, preferably, using nitrogen. More preferably, to more effectively prevent the corrosion of copper and copper alloy, the resist removal is performed in an atmosphere having an oxygen concentration of 2% by volume or less while maintaining the dissolved oxygen content of the resist stripping composition at 3 ppm or less by blowing a gas such as nitrogen, argon and hydrogen thereinto. The resist stripping composition may be deaerated before use. As described above, the resist stripping method of the present invention is most effective to remove the resists remaining on the substrate having a copper layer or a copper alloy layer.

[0027] Also, the inventors have found that the pretreatment by hydrogen peroxide is effective to remove the resist having their properties changed significantly. The pretreatment with hydrogen peroxide oxidizes the surface of resist having its properties changed significantly to reduce the molecular weight, thereby promoting the formation of carbonyl group. As described above, this facilitates the removal of resists.

[0028] The pretreatment with hydrogen peroxide is carried out by bringing the wiring substrate, after etching and before treatment by the resist stripping composition, into contact with hydrogen peroxide, for example, by immersing the wiring substrate in a solution containing 0.5% by weight or more, preferably 1 to 10% by weight of hydrogen peroxide at 20 to 60° C. for 1 to 30 min. The hydrogen peroxide solution may be an aqueous solution. An additive such as a chelating agent and a surfactant may be added into the hydrogen peroxide solution. The wiring substrate pretreated with hydrogen peroxide is subjected to the resist removal operation directly or after washing with water.

[0029] The present invention will be explained in more detail by reference to the following examples which should not be construed to limit the scope of the present invention.

EXAMPLES 1 to 6 and COMPARATIVE EXAMPLES 1 and 2

[0030] Via hole structure was formed by dry etching on a 6-inch wafer having a copper layer, a SiN layer, a SiO_2 interlaminar insulating layer and a resist layer which were laminated in this order on a silicon substrate. The via hole structure reached the copper layer. The substrate was immersed into a resist stripping composition having a formulation shown below at 70° C. for 30 min. After rinsed with water, the degrees of resist removal and the corrosion of copper layer were examined under a scanning electron microscope. The results are shown in Table 2.

[0031] The amount of dissolved oxygen in the resist stripping composition was measured in a nitrogen atmosphere by a digital oxygen analyzer (Model DO-5509, lower detection limit: 0.5 ppm) available from N. T. Corporation.

TABLE 1

	Resist Stripping Composition						
	Amine Compound		Solvent		Strong Alkali		
	Kind	wt %	Kind	wt %	Kind	wt %	Water
Examples							
1	EA	30	DMSO	60	TMAH	0.2	balance
2	EA	25	NMP	65	TMAH	1	balance
3	1A2P	32	PG	61	TMAH	0.5	balance
4	TETA	18	DGME	72	CH	1	balance
5	PEHA	30	DGBE	60	TMAH	2	balance
6	AEEA	10	MEA	80	CH	0.1	balance
Comparative Examples							
1	EA	30	DMSO	60	—	—	balance
2	EA	30	DMSO	60	TMAH	0.2	balance

EA: ethanolamine
1A2P: 1-amino-2-propanol
TETA: triethylenetetramine
PEHA: pentaethylenehexamine
AEEA: aminoethylethanolamine
TMAH: tetramethylammonium hydroxide
CH: choline hydroxide
DMSO: dimethyl sulfoxide
NMP: N-methylpyrrolidone
PG: propylene glycol
DGME: diethylene glycol monomethyl ether
DGBE: diethylene glycol monobutyl ether
MEA: N-methylethanolamine

[0032]

TABLE 2

	Atmospheric Oxygen Concentration (ppm)	Resist Removal	Copper Corrosion	Dissolved Oxygen Concentration (ppm)
Examples				
1	500	good	none	0.5 or less
2	200	good	none	0.6
3	400	good	none	1.3
4	800	good	none	0.5 or less
5	200	good	none	1.5
6	400	good	none	0.5 or less
Comparative Examples				
1	500	not removed	none	0.5 or less
2	200000	good	significant	5.8

EXAMPLES 7 to 12 and COMPARATIVE EXAMPLES 3 and 4

[0033] Via hole structure was formed by dry etching on a 12-inch wafer having a copper layer, a SiN layer, a SiO_2 interlaminar insulating layer and a resist layer which were laminated in this order on a silicon substrate. The via hole

structure reached the copper layer. The substrate was subjected to the pretreatment by immersion into a solution shown in Table 3 at 60° C. for 15 min, and then, was immersed into a resist stripping composition having a formulation shown in Table 3 at 70° C. for 30 min. After rinsed with water, the degrees of resist removal and the corrosion of copper layer were examined under a scanning electron microscope. The results are shown in Table 4.

TABLE 3

	Pretreatment		Resist Stripping Composition						
	Hydrogen Peroxide		Amine Compound		Solvent		Strong Alkali		
	Concentration (wt %)	Additive (wt %)	Kind	wt %	Kind	wt %	Kind	wt %	Water
Examples									
7	6	—	EA	30	DMSO	60	TMAH	0.2	balance
8	5	EDTA (0.001)	TETA	25	NMP PG	25 40	TMAH	1	balance
9	3	—	1A2P	25	DMSO	65	TMAH	1.5	balance
10	4	NH_4F (0.001)	EA	18	DGME	72	CH	1	balance
11	4	—	PEHA	30	DGBE	60	TMAH	2	balance
12	4	—	AEEA	10	MEA	80	CH	0.1	balance
Comparative Examples									
3	—	—	EA	30	DMSO	60	TMAH	0.2	balance
4	—	—	EA	25	NMP	65	TMAH	1	balance

EA: ethanolamine
1A2P: 1-amino-2-propanol
TETA: triethylenetetramine
PEHA: pentaethylenehexamine
AEEA: aminoethylethanolamine
TMAH: tetramethylammonium hydroxide
CH: choline hydroxide
DMSO: dimethyl sulfoxide
NMP: N-methylpyrrolidone
PG: propylene glycol
DGME: diethylene glycol monomethyl ether
DGBE: diethylene glycol monobutyl ether
MEA: N-methyl ethanol amine
EDTA: ethylenediaminetetraacetic acid

[0034]

TABLE 4

	Atmospheric Oxygen Concentration (ppm)	Resist Removal	Copper Corrosion	Dissolved Oxygen Concentration (ppm)
Examples				
7	200	good	none	0.5 or less
8	200	good	none	0.5 or less
9	200	good	none	1.0
10	200	good	none	0.5 or less
11	200	good	none	0.5 or less
12	200	good	none	0.5 or less
Comparative Examples				
3	200	not removed	none	0.5 or less
4	200	not removed	none	0.5 or less

[0035] As seen from Tables 2 and 4, the resists on the wiring substrate can be removed without any corrosion of copper layer by the resist stripping method of the present invention. In addition, by the pretreatment with hydrogen peroxide, the resist removal was facilitated even when the resist removal was difficult only by the resist stripping composition.

EXAMPLES 13 to 15 and COMPARATIVE EXAMPLE 5

[0036] A silicon substrate having a copper layer of 400 Å thick was immersed into the resist stripping composition having the following formulation to measure the corrosion rate of the copper layer at 50° C. The results are shown in Table 5.

[0037] Resist Stripping Composition

[0038] ethanolamine: 45% by weight

[0039] diethylene glycol monomethyl ether: 20% by weight

[0040] water: 32% by weight

[0041] sorbitol: 3% by weight

TABLE 5

	Atmospheric Conditions	Corrosion Rate (Å/min)
Examples		
13	in nitrogen atmosphere	0.7
14	treatment while blowing nitrogen gas into resist stripping composition	0.3
15	in nitrogen containing 1% oxygen	1
Comparative Example		
5	in air	7

[0042] It was found that the corrosion rate of copper largely affected by oxygen. If air is continuously supplied, the corrosion of copper is also continuously promoted. Therefore, the oxygen source should be removed to prevent copper from the corrosion.

EXAMPLES 16 and 17 and COMPARATIVE EXAMPLE 6

[0043] A silicon substrate having a copper layer of 400 Å thick was immersed into the resist stripping composition having the following formulation to measure the corrosion rate of the copper layer at 50° C. The measurement was performed in a globe box equipped with an atmospheric oxygen analyzer. The results are shown in Table 6.

[0044] Resist Stripping Composition

[0045] ethanol amine: 40% by weight

[0046] diethylene glycol monobutyl ether: 38% by weight

[0047] water: 20% by weight

[0048] catechol: 2% by weight

TABLE 6

	Atmospheric Conditions	Corrosion Rate (Å/min)
Examples		
16	in nitrogen atmosphere containing 200 ppm oxygen	1.3
17	in nitrogen atmosphere containing 200 ppm oxygen, after deaeration of resist stripping composition	0.5
Comparative Example		
6	in air	2.0

EXAMPLE 18 and COMPARATIVE EXAMPLE 7

[0049] A silicon substrate having a copper layer of 400 Å thick was immersed into the resist stripping composition having the following formulation to measure the corrosion rate of the copper layer at 50° C. The measurement was performed in a globe box equipped with an atmospheric oxygen analyzer.

[0050] Resist Stripping Composition

[0051] ethanol amine: 30% by weight

[0052] N-methylpyrrolidone: 55% by weight

[0053] water: 10% by weight

[0054] catechol: 5% by weight

[0055] After applied with a photoresist, patterned and dry-etched, the silicon substrate was immersed into the resist stripping composition at 50° C. for 30 min. The time required for removing the remaining resist was measured while observing under an optical microscope. The results are shown in Table 7.

TABLE 7

	Atmospheric Conditions	Corrosion Rate (Å/min)	Time for Removing Resist (min)
Example			
18	in nitrogen atmosphere	0.8	15
Comparative Example			
7	in air	4.5	15

[0056] By carrying out the resist removal in nitrogen (in a low-oxygen atmosphere), the corrosion of copper is prevented without affecting the resist removing ability.

INDUSTRIAL APPLICABILITY

[0057] According to the present invention, the resist after dry etching is removed without the corrosion of copper. Thus, the present invention makes it possible to use the conventional resist stripping compositions which are detrimental to the treatment of substrates having copper wiring. In addition, the resists difficult to be removed can be easily removed by the pretreatment with hydrogen peroxide.

1. A resist stripping method comprising a step of bringing a wiring substrate having a remaining resist layer after etching into contact with a resist stripping composition in an atmosphere containing oxygen in a proportion of 2% by volume or less.

2. The resist stripping method according to claim 1, wherein the step of bringing the wiring substrate into contact with the resist stripping composition is performed while driving out dissolved gas from the resist stripping composition.

3. The resist stripping method according to claim 1, wherein the step of bringing the wiring substrate into contact with the resist stripping composition is performed after deaeration of the resist stripping composition.

4. The resist stripping method according to claim 1, wherein the remaining resist layer is subjected to a pretreatment by a contact with hydrogen peroxide before bringing the wiring substrate into contact with the resist stripping composition.

5. The resist stripping method according to claim 4, wherein the pretreatment is performed by bringing the remaining resist layer into contact with a solution having a hydrogen peroxide concentration of 0.5% by weight or higher.

6. The resist stripping method according to claim 1, wherein a dissolved oxygen concentration in the resist stripping composition is 3 ppm or less.

7. The resist stripping method according to claim 1, wherein the resist stripping composition comprises an amine compound, a solvent, a strong alkali, and water.

8. The resist stripping method according to claim 7, wherein the resist stripping composition comprises 5 to 95% by weight of the amine compound, 3 to 85% by weight of the solvent, 0.01 to 5% by weight of the strong alkali, and 1 to 25% by weight of water.

9. The resist stripping method according to claim 7, wherein the amine compound is at least one compound selected from the group consisting of ethanolamine, 1-amino-2-propanol, N-(aminoethyl)ethanolamine, N-methylethanolamine, N-ethylethanolamine, diethanolamine, isopropanolamine, 2-(2-aminoethoxy)ethanol, ethylenediamine, propanediamine, butylenediamine, diethylenetriamine, piperazine, morpholine, triethylenetetramine, tetraethylenepentamine, and pentaethylenehexamine.

10. The resist stripping method according to claim 7, wherein the strong alkali is at least one compound selected from the group consisting of tetramethylammonium hydroxide, choline hydroxide, tetraethylammonium hydroxide, and tetrabutylammonium hydroxide.

11. The resist stripping method according to claim 7, wherein the solvent is at least one compound selected from the group consisting of dimethyl sulfoxide, N,N-dimethylformamide, N,N-dimethylacetamide, N-methylpyrrolidone, diethylene glycol monomethyl ether, diethylene glycol monobutyl ether, dipropylene glycol monomethyl ether, dipropylene glycol monobutyl ether, and propylene glycol.

12. The resist stripping method according to claim 7, wherein the wiring substrate has a copper layer or a copper alloy layer.

13. The resist stripping method according to claim 2, wherein the remaining resist layer is subjected to a pretreatment by a contact with hydrogen peroxide before bringing the wiring substrate into contact with the resist stripping composition.

14. The resist stripping method according to claim 13, wherein the pretreatment is performed by bringing the remaining resist layer into contact with a solution having a hydrogen peroxide concentration of 0.5% by weight or higher.

15. The resist stripping method according to claim 3, wherein the remaining resist layer is subjected to a pretreatment by a contact with hydrogen peroxide before bringing the wiring substrate into contact with the resist stripping composition.

16. The resist stripping method according to claim 15, wherein the pretreatment is performed by bringing the remaining resist layer into contact with a solution having a hydrogen peroxide concentration of 0.5% by weight or higher.

17. The resist stripping method according to claim 8, wherein the amine compound is at least one compound selected from the group consisting of ethanolamine, 1-amino-2-propanol, N-(aminoethyl)ethanolamine, N-methylethanolamine, N-ethylethanolamine, diethanolamine, isopropanolamine, 2-(2-aminoethoxy)ethanol, ethylenediamine, propanediamine, butylenediamine, diethylenetriamine, piperazine, morpholine, triethylenetetramine, tetraethylenepentamine, and pentaethylenehexamine.

18. The resist stripping method according to claim 17, wherein the strong alkali is at least one compound selected from the group consisting of tetramethylammonium hydroxide, choline hydroxide, tetraethylammonium hydroxide, and tetrabutylammonium hydroxide.

19. The resist stripping method according to claim 9, wherein the strong alkali is at least one compound selected from the group consisting of tetramethylammonium hydroxide, choline hydroxide, tetraethylammonium hydroxide, and tetrabutylammonium hydroxide.

20. The resist stripping method according to claim 8, wherein the strong alkali is at least one compound selected from the group consisting of tetramethylammonium hydroxide, choline hydroxide, tetraethylammonium hydroxide, and tetrabutylammonium hydroxide.

21. The resist stripping method according to claim 10, wherein the solvent is at least one compound selected from the group consisting of dimethyl sulfoxide, N,N-dimethylformamide, N,N-dimethylacetamide, N-methylpyrrolidone, diethylene glycol monomethyl ether, diethylene glycol monobutyl ether, dipropylene glycol monomethyl ether, dipropylene glycol monobutyl ether, and propylene glycol.

22. The resist stripping method according to claim 10, wherein the wiring substrate has a copper layer or a copper alloy layer.

* * * * *