The Claims

1. A solution for selectively etching copper or a copper alloy from a microelectronic device simultaneously including copper or a copper alloy and nickel-containing material, the solution comprising: a chelating agent (A) having an acid group in a molecule; hydrogen peroxide (B); and a surfactant (C) comprising an ethylene oxide (EO) adduct of an alkylamine, wherein the chelating agent (A) comprises an organic acid selected from the group consisting of ethylenediaminetetraacetic acid, diethylenetriaminepentaacetic acid,
triethylenetetraminehexaacetic acid, hydroxyethylethylenediaminetriacetic acid,
dihydroxyethylethylenediaminetetraacetic acid, nitrilotriacetic acid,
hydroxyethyliminodiacetic acid, β-alaninediacetic acid, aspartate diacetic acid,
methylglycinediacetic acid, iminodisuccinic acid, serinediacetic acid,
hydroxyiminodisuccinic acid, tartaric acid, citric acid, pyromellitic acid, benzopolycarboxylic acid,
cyclopentanetetracarboxylic acid, methyldiphosphonic acid,
aminotri(methylenephosphonic acid), 1-hydroxyethylidene-1,1-diphosphonic acid (HEDP),
ethylenediaminetetra(methylenephosphonic acid),
hexamethylenediaminetetra(methylenephosphonic acid),
propylenediaminetetra(methylenephosphonic acid),
diethylenetriaminepenta(methylenephosphonic acid),
triethylenetetraminehexa(methylenephosphonic acid),
triaminotriethylaminehexa(methylenephosphonic acid),
trans-1,2-cyclohexanediaminetetra(methylenephosphonic acid),
glycoletherdiaminetetra(methylenephosphonic acid),
tetraethylenepentaminehepta(methylenephosphonic acid), methanedisulfonic acid,
ethanedisulfonic acid, phenoldisulfonic acid, naphthalenedisulfonic acid, piperazine-1,4-bis(2-ethanesulfonic acid), phosphonoacetic acid, 2-hydroxy-2-phosphonoacetic acid,
carboxyphosphonic acid, 3-phosphonopropionic acid, 4-(3-phosphonopropyl)-2-piperazinecarboxylic acid, lactic acid, salicylic acid, gallic acid, 2-hydroxyethylphosphonic acid, 2-hydroxyethanesulfonic acid, salts thereof, and combinations thereof and wherein a ratio (A)/(B) of a weight of the chelating agent (A) to that of hydrogen peroxide (B) is 2 to 20, and wherein a ratio (A)/(C) of a weight of the chelating agent (A) to that of the surfactant (C) is 2 to 50.

2. The solution according to claim 1, further comprising at least one solvent (D).

3. The solution according to claim 2, wherein the at least one solvent comprises a species selected from the group consisting of water, methanol, ethanol, isopropanol, n-propanol, n-hexanol, n-octanol, 2-

ethylhexanol, cyclohexanol, ethylene glycol, propylene glycol, 1,4-butanediol, 1,6-hexandiol, tetrahydrofurfuryl alcohol, glycerol, propylene glycol monomethyl ether, propylene glycol monomethyl ether acetate, ethylene glycol monomethyl ether, ethylene glycol monomethyl ether acetate, ethylene glycol monomethyl ether propionate, ethylene glycol monobutyl ether, ethylene glycol monobutyl ether acetate, diethyl ether, diisopropyl ether, dibutyl ether, tetrahydrofuran, 1,4-dioxane, ethyl lactate, methyl 3-methoxypropionate, methyl acetate, ethyl acetate, propyl acetate, γ-butyrolactone, acetone, methyl ethyl ketone, methyl isopropyl ketone, methyl isobutyl ketone, methyl amyl ketone, cyclopentanone, cyclohexanone, dimethyl carbonate, diethyl carbonate, ethylene carbonate, propylene carbonate, N,N-dimethylacetamide, N,N-dimethylformamide, and combinations thereof.

4. The solution according to claim 2, wherein the at least one solvent comprises water.

5. The solution according to claim 1, further comprising at least one component selected from the group consisting of at least one anticorrosive component (E), at least one antioxidant (F), and at least one basic compound (G).

6. The solution according to claim 5, comprising at least one anticorrosive component (E) selected from the group consisting of benzotriazole, o-tolyltriazole, m-tolyltriazole, p-tolyltriazole, carboxy benzotriazole, 1-hydroxybenzotriazole, nitrobenzotriazole, dihydroxypropylbenzotriazole, imidazole, benzimidazole, benzimidazole carboxylic acid, imidazole-2-carboxylic acid, imidazole-4-carboxylic acid, imidazole-2-carboxyaldehyde, imidazole-4-carboxyaldehyde, 4-imidazoledithiocarboxylic acid, mercaptothiazole, mercaptoethanol, thioglycerol, erythritol, threitol, arabinitol, xylitol, ribitol, mannitol, sorbitol, maltitol, and inositol.

7. The solution according to claim 5, comprising at least one anti-oxidant (F) selected from the group consisting of catechin, tocopherol, catechol, methylcathecol, ethylcatechol, tert-butylcatechol, gallic acid, methyl gallate, propyl gallate, 3-hydroxyflavone, and ascorbic acid.

8. The solution according to claim 5, comprising at least one basic compound (G) selected from the group consisting of methylamine, ethylamine, propylamine, isopropylamine, butylamine, hexylamine, dimethylamine, ethylmethylamine, propylmethylamine, butylmethylamine, diethylamine, propylethylamine, diisopropylamine, trimethylamine, ethyldimethyl amine, diethylmethylamine, triethylamine, tri-n-propylamine, tri-n-butylamine, monoethanolamine, diethanolamine, triethanolamine, dimethylaminoethanol, diethylaminoethanol, 2-amino-2-methyl-1-propanol, N-(aminoethyl)ethanolamine, N,N-dimethyl-2-aminoethanol, 2-(2-aminoethoxy)ethanol, ethylenediamine, propylenediamine, trimethylenediamine, tetramethylenediamine,

hexamethylenediamine, diethylenetriamine, triethylenetetramine, tetraethylenepentamine, hexamethyleneheptamine, iminobispropylamine, bis(hexamethylene)triamine, pentaethylenehexamine, aniline, phenylenediamine, tolylenediamine, xylylenediamine, methylenedianiline, diphenyletherdiamine, naphthalenediamine, anthracenediamine, isophoronediamine, cyclohexylenediamine, piperazine, N-aminoethylpiperazine, 1,4-diaminoethylpiperazine, tetramethylammonium hydroxide, tetraethylammonium hydroxide, choline, pyrrole, imidazole, pyrazole, oxazol, thiazole, pyridine, pyrimidine, pyridazine, pyrazine, bipyridine, and phenanthroline.

9. The solution according to claim 1, wherein the pH is in a range from 0 to 5.

10. A method for producing a microelectronic device, the method comprising selectively etching copper or a copper alloy from the microelectronic device using a solution, wherein the device simultaneously includes copper or copper alloy and nickel-containing material, wherein the solution is any one of claims 1 to 9.