THE CLAIMS

What is claimed is:

1. An aqueous-based removal composition useful for removing photoresist and/or bottom anti-reflective coating (BARC) materials from a microelectronic device substrate having such material(s) thereon, said composition comprising at least one chaotropic solute and at least one alkaline salt in an aqueous medium, wherein the removal composition is useful for removing photoresist and/or BARC materials from a microelectronic device having such materials thereon.

2. The composition of claim 1, comprising the following components based on the total weight of the composition:

60.0 % wt. – 98.0 % wt. deionized water

1.0 % wt. - 30.0 % wt. chaotropic solute; and

1.0 % wt. – 10.0 % wt. alkaline salt,

wherein the total of the weight percentages of such components of the composition does not exceed 100 % weight.

3. The composition of claim 1, wherein the at least one chaotropic solute comprises a chaotropic species selected from the group consisting of: urea; guanidinium chloride; 2-, 3-, and 4-aminobenzoic acid; 2-, 3-, and 4-nitrobenzoic acid; 2-, 3-, and 4- anisic acid; 2-, 3-, and 4-fluoro-, chloro-, bromo-, and iodo-benzoic acid; 2-, 3-, and 4-methylthio-benzoic acid; 2,4-diamino-6-methyl-1,3,5-triazine; aniline; 2-, 3-, and 4-methylthio-aniline; 2-, 3-, and 4-anisidine; 1,2-, 1,3-, and 1,4-phenylenediamine; 1,3,5-triazine; melamine; acetoguanamine; 2,4-diamino-6-phenyl-1,3,5-triazine; 2-chloro-4,6-diamino-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2,4-diamino-1,3,5-triazine; 2-amino-1,3,5-triazine; 2-amino-4-ethoxy-6-

(methylamino)-1,3,5-triazine; 2-methoxy-4-methyl-6-(methylamino)-1,3,5-triazine; 1,2,4-triazole; imidazole; 2-mercaptoimidazole; 2-mercaptobenzimidazole; chaotropic anions selected from the group consisting of chloride salts, bromide salts, iodide salts, nitrate salts, thiocyanide salts, chlorate salts, and benzoate salts; and combinations thereof.

4. The composition of claim 3, wherein the cation associated with the chaotropic anion comprises $(NR^1R^2R^3R^4)^+$, wherein R^1, R^2, R^3 and R^4 may be the same as or different from one another and each is independently selected from the group consisting of hydrogen and C_1-C_6 alkyl groups.

5. The composition of claim 1, wherein the at least one chaotropic solute comprises a chaotropic anion having an atomic or molecular radius of greater than or equal to 1.6Å.

6. The composition of claim 1, wherein the at least one chaotropic solute comprises urea.

7. The composition of claim 1, wherein the at least one alkaline salt comprises $(NR^1R^2R^3R^4)OH$, wherein R^1, R^2, R^3 and R^4 may be the same as or different from one another and each is independently selected from the group consisting of hydrogen and C_1-C_6 alkyl groups.

8. The composition of claim 1, having a pH greater than about 13.

9. The composition of claim 1, selected from the group consisting of Formulations A-H, wherein all percentages are by weight, based on the total weight of the formulation:

Formulation A

2.5 wt. % tetramethylammonium hydroxide;

20.0 wt. % urea;

77.5 wt. % deionized water;

Formulation B

1.5 wt. % tetramethylammonium hydroxide;

1.6 wt. % 2,4-diamino-6-methyl-1,3,5-triazine;

20.0 wt. % urea;

76.9 wt. % deionized water;

Formulation C

2.0 wt. % tetramethylammonium hydroxide;

1.0 wt. % 2,4-diamino-6-methyl-1,3,5-triazine;

1.0 wt. % 4-aminobenzoic acid;

96.0 wt. % deionized water;

Formulation D

2.0 wt. % tetramethylammonium hydroxide;

2.4 wt. % tetramethylammonium nitrate;

95.6 wt. % deionized water;

Formulation E

5.0 wt. % tetramethylammonium hydroxide;

9.0 wt. % tetramethylammonium nitrate;

10.0 wt. % butyl carbitol;

10.0 wt. % sulfolane-w;

66.0 wt. % deionized water;

Formulation F

8.2 wt. % tetrabutylammonium hydroxide;

20.0 wt. % sulfolane A

30.0 wt. % methyl carbitol;

17.0 wt. % propylene glycol

2.0 wt. % 2,4-diamino-6-methyl-1,3,5-triazine

22.8 wt. % deionized water;

Formulation G

6.0 wt. % benzyltrimethylammonium hydroxide

10.0 wt. % sulfolane A

10.0 wt. % methyl carbitol;

20.0 wt. % propylene glycol

2.0 wt. % 2,4-diamino-6-methyl-1,3,5-triazine

52 wt. % deionized water; and

Formulation H

2.9 wt. % benzyltrimethylammonium hydroxide

0.025 wt. % potassium hydroxide

22.0 wt. % sulfolane A

27.0 wt. % methyl carbitol;

17.9 wt. % propylene glycol

1.5 wt. % urea

0.08% 2-mercaptobenzimidazole

28.595 wt. % deionized water.

10. A method of removing photoresist and/or BARC material from a substrate having said material thereon, said method comprising contacting the substrate with an aqueous-based removal composition for sufficient time to at least partially remove said material from the substrate, wherein the aqueous-based removal composition comprises at least one chaotropic solute and at least one alkaline salt in an aqueous medium.

11. The method of claim 10, wherein the aqueous-based removal composition comprises the following components, based on the total weight of the composition:

60.0 % wt. – 98.0 % wt. deionized water

1.0 % wt. - 30.0 % wt. chaotropic solute; and

1.0 % wt. – 10.0 % wt. alkaline salt,

wherein the total of the weight percentages of such components of the composition does not exceed 100 % weight.

12. The method of claim 10, wherein the substrate comprises a microelectronic device structure.

13. The method of claim 10, wherein the material comprises a layer selected from the group consisting of: photoresist hardened by plasma etching; photoresist hardened by ion implantation; and BARC.

14. The method of claim 10, wherein said contacting is carried out for a time of from about 1 minute to about 60 minutes.

15. The method of claim 10, wherein said contacting is carried out at temperature in a range of from about 40°C to about 80°C.

16. The method of claim 10, wherein the at least one chaotropic solute comprises a chaotropic species selected from the group consisting of: urea; guanidinium chloride; 2-, 3-, and 4-aminobenzoic acid; 2-, 3-, and 4-nitrobenzoic acid; 2-, 3-, and 4- anisic acid; 2-, 3-, and 4-fluoro-, chloro-, bromo-, and iodo-benzoic acid; 2-, 3-, and 4-methylthio-benzoic acid; 2,4-diamino-6-methyl-1,3,5-triazine; aniline; 2-, 3-, and 4-methylthio-aniline; 2-, 3-, and 4-anisidine; 1,2-, 1,3-, and 1,4-phenylenediamine; 1,3,5-triazine; melamine; acetoguanamine; 2,4-diamino-6-phenyl-1,3,5-triazine; 2-chloro-4,6-diamino-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2,4-diamino-1,3,5-triazine; 2-amino-1,3,5-triazine; 2-amino-4-ethoxy-6-(methylamino)-1,3,5-triazine; 2-methoxy-4-methyl-6-(methylamino)-1,3,5-triazine; 1,2,4-triazole; imidazole; 2-mercaptoimidazole; 2-mercaptobenzimidazole; chaotropic anions selected from the group consisting of chloride salts, bromide salts, iodide salts, nitrate salts, thiocyanide salts, chlorate salts, and benzoate salts; and combinations thereof.

17. The method of claim 16, wherein the cation associated with the chaotropic anion comprises $(NR^1R^2R^3R^4)^+$, wherein R^1, R^2, R^3 and R^4 may be the same as or different from one another and each is independently selected from the group consisting of hydrogen and C_1-C_6 alkyl groups.

18. The method of claim 10, wherein the at least one alkaline salt comprises $(NR^1R^2R^3R^4)OH$, wherein R^1, R^2, R^3 and R^4 may be the same as or different from one another and each is independently selected from the group consisting of hydrogen and C_1-C_6 alkyl groups.

19. The method of claim 10, wherein the aqueous-based removal composition is selected from the group consisting of Formulations A-E, wherein all percentages are by weight, based on the total weight of the formulation:

Formulation A

2.5 wt. % tetramethylammonium hydroxide;

20.0 wt. % urea;

77.5 wt. % deionized water;

Formulation B

1.5 wt. % tetramethylammonium hydroxide;

1.6 wt. % 2,4-diamino-6-methyl-1,3,5-triazine;

20.0 wt. % urea;

76.9 wt. % deionized water;

Formulation C

2.0 wt. % tetramethylammonium hydroxide;

1.0 wt. % 2,4-diamino-6-methyl-1,3,5-triazine;

1.0 wt. % 4-aminobenzoic acid;

96.0 wt. % deionized water;

Formulation D

2.0 wt. % tetramethylammonium hydroxide;

2.4 wt. % tetramethylammonium nitrate;

95.6 wt. % deionized water;

and

Formulation E

5.0 wt. % tetramethylammonium hydroxide;

9.0 wt. % tetramethylammonium nitrate;

10.0 wt. % butyl carbitol;

10.0 wt. % sulfolane-w;

66.0 wt. % deionized water.

20. The method of claim 10, further comprising rinsing the substrate with deionized water following contact with the aqueous-based removal composition.

CLAIMS

1. An aqueous-based removal composition, said composition comprising at least one chaotropic solute and at least one alkaline salt in an aqueous medium, wherein the at least one chaotropic solute comprises a chaotropic species selected from the group consisting of: guanidinium salts; anionic benzoate salts and benzoate derivatives; substituted aniline; 1,2-, 1,3-, and 1,4-phenylenediamine; 1,2,4-triazole; substituted 1,2,4-triazole; 2-mercaptoimidazole; acetoguanamine; 2-chloro-4,6-diamino-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2-amino-4-ethoxy-6-(methylamino)-1,3,5-triazine; 2-methoxy-4-methyl-6-(methylamino)-1,3,5-triazine; 2-mercaptobenzimidazole; chlorides, bromides, iodides, nitrates, thiocyanides and chlorates of a $(NR^1R^2R^3R^4)^+$ cation, wherein R^1, R^2, R^3 and R^4 may be independently selected from the group consisting of hydrogen and C_1-C_6 alkyl groups; and combinations thereof, and wherein the removal composition is useful for removing photoresist and/or bottom anti-reflective coating (BARC) materials from a microelectronic device.

2. The composition of claim 1, further comprising urea.

3. The composition of claim 1, wherein the anionic benzoate salts and benzoate derivatives comprise a species selected from the group consisting of 2-, 3-, and 4-aminobenzoic acid; 2-, 3-, and 4-nitrobenzoic acid; 2-, 3-, and 4- anisic acid; 2-, 3-, and 4-fluoro-, chloro-, bromo-, and iodo-benzoic acid; and 2-, 3-, and 4-methylthio-benzoic acid; and

   wherein the substituted aniline comprises a species selected from the group consisting of 2-, 3-, and 4-methylthio-aniline; and 2-, 3-, and 4-anisidine.

4. The composition of claim 1, wherein the at least one alkaline salt comprises $(NR^1R^2R^3R^4)OH$, wherein R^1, R^2, R^3 and R^4 may be the same as or different from one another and each is independently selected from the group consisting of hydrogen, C_1-C_6 alkyl groups, and benzyl groups.

5. The composition of claim 1, further comprising co-solvent, wherein the co-solvent is selected from the group consisting of straight-chained C_1-C_6 alcohols, branched C_1-C_6 alcohols, diethylene glycol butyl ether, diethylene glycol methyl ether, sulfolane-w, sulfolane-A, and propylene glycol.

6. The composition of claim 1, selected from the group consisting of Formulations C, D, E, F and I wherein all percentages are by weight, based on the total weight of the formulation:

Formulation C

2.0 wt. % tetramethylammonium hydroxide

2.4 wt. % tetramethylammonium nitrate

95.6 wt. % deionized water,

Formulation D

5.0 wt. % tetramethylammonium hydroxide

9.0 wt. % tetramethylammonium nitrate

10.0 wt. % butyl carbitol

10.0 wt. % sulfolane-w

66.0 wt. % deionized water,

Formulation E

from 1.0 wt. % to 5.0 wt. % tetramethylammonium hydroxide

from 1.0 wt. % to 20.0 wt. % of 2-, 3-, or 4-nitrobenzoic acid tetramethylammonium salt

remainer deionized water,

Formulation F

from 1.0 wt. % to 5.0 wt. % tetramethylammonium hydroxide

from 1.0 wt. % to 20.0 wt. % of ortho-, meta-, or para-phenylenediamine

remainer deionized water, and

Formulation I

2.9 wt. % benzyltrimethylammonium hydroxide

0.025 wt. % potassium hydroxide

22.0 wt. % sulfolane A

27.0 wt. % methyl carbitol

17.9 wt. % propylene glycol

1.5 wt. % urea

0.08% 2-mercaptobenzimidazole

28.595 wt. % deionized water.

7. A method of removing photoresist and/or BARC material from a substrate, said method comprising contacting the substrate with an aqueous-based removal composition for sufficient time to at least partially remove photoresist and/or BARC material from the substrate, wherein the aqueous-based removal composition comprises at least one chaotropic solute and at least one alkaline salt in an aqueous medium, wherein the at least one chaotropic solute comprises a chaotropic species selected from the group consisting of: guanidinium salts; anionic benzoate salts and benzoate derivatives; substituted aniline; 1,2-, 1,3-, and 1,4-phenylenediamine; 1,2,4-triazole; substituted 1,2,4-triazole; 2-mercaptoimidazole; acetoguanamine; 2-chloro-4,6-diamino-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2-amino-4-ethoxy-6-(methylamino)-1,3,5-triazine; 2-methoxy-4-methyl-6-(methylamino)-1,3,5-triazine; 2-mercaptobenzimidazole; chlorides, bromides, iodides, nitrates, thiocyanides and chlorates of a $(NR^1R^2R^3R^4)^+$ cation, wherein R^1, R^2, R^3 and R^4 may be independently selected from the group consisting of hydrogen and C_1-C_6 alkyl groups; and combinations thereof.

8. The method of claim 7, wherein the substrate comprises a microelectronic device structure, and wherein the material comprises a layer selected from the group consisting of: photoresist hardened by plasma etching; photoresist hardened by ion implantation; and BARC.

9. The method of claim 7, wherein said contacting is selected from the group consisting of: a time of from 1 minute to 60 minutes; temperature in a range of from 40ºC to 80ºC; and combinations thereof.

10. The method of claim 7, wherein the aqueous-based removal composition further comprises urea.

11. The method of claim 7, wherein the at least one alkaline salt comprises $(NR^1R^2R^3R^4)OH$, wherein R^1, R^2, R^3 and R^4 may be the same as or different from one another and each is independently selected from the group consisting of hydrogen, C_1-C_6 alkyl groups, and benzyl groups.

12. The method of claim 7, further comprising rinsing the substrate with deionized water following contact with the aqueous-based removal composition.

13. A method of making a microelectronic device, said method comprising removing photoresist and/or BARC layers from a microelectronic device having said material(s) thereon using the aqueous-based removal composition of claim 1.

14. A kit comprising, in one or more containers, reagents for forming an aqueous-based removal composition, wherein said removal composition comprises at least one chaotropic solute and at least one alkaline salt in an aqueous medium, wherein the at least one chaotropic solute comprises a chaotropic species selected from the group consisting of: guanidinium salts; anionic benzoate salts and benzoate derivatives; substituted aniline; 1,2-, 1,3-, and 1,4-phenylenediamine; 1,2,4-triazole; substituted 1,2,4-triazole; 2-mercaptoimidazole; acetoguanamine; 2-chloro-4,6-diamino-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2,4,6-trimethoxy-1,3,5-triazine; 2-amino-4-ethoxy-6-(methylamino)-1,3,5-triazine; 2-methoxy-4-methyl-6-(methylamino)-1,3,5-triazine; 2-mercaptobenzimidazole; chlorides, bromides, iodides, nitrates, thiocyanides and chlorates of a $(NR^1R^2R^3R^4)^+$ cation, wherein R^1, R^2, R^3 and R^4 may be independently selected from the group consisting of hydrogen and C_1-C_6 alkyl groups, and wherein the kit is adapted to form an aqueous-based removal composition suitable for removing material photoresist and/or BARC material from a substrate.

15. The composition of claim 1, wherein the pH is greater than 13.