CLAIMS

What is claimed is:

1. A composition comprising:

(i) water;

(ii) one or more oxidizing agents comprising between 0.1 wt% ± 5 % and 1.0 wt% ± 5 % of neat nitric acid, and one or more of peroxomonosulfate, perborate, perchlorate, perchloric acid, peracetate anions, periodate, persulfate, permanganate, chromate, dichromate, benzoquinones, nitrosylsulfuric acid, or an amine-N-oxide, in addition to nitric acid;

(iii) one or more acids other than the nitric acid, the one or more acids comprise one or more of sulfuric acid, hydrochloric acid, methane sulfonic acid, 4-methylbenzenesulfonic acid, hydrobromic acid, citric acid, malonic acid, acetic acid, phosphoric acid, and hydroiodic acid; and

(iv) one or more halogen ion source,

wherein the composition is substantially free of fluorine-containing compounds.

2. The composition of claim 1, further comprising **(v)** one or more chelating agent.

3. The composition of claim 1, wherein the one or more oxidizing agents further comprises one or more of ammonium persulfate, 2,5-dihydroxy-1,4-benzoquinone, nitrosylsulfuric acid, and pyridine N-oxide, 4-methylmorpholine-N-oxide.

4. The composition of claim 1, wherein a total wt% of neat acid in the composition is 30 wt% ± 5 % to 45 wt% ± 5 %.

5. The composition of claim 1, wherein a total wt% of neat acid in the composition is 35 wt% ± 5 % to 45 wt% ± 5 %.

6. The composition of claim 1, wherein the one or more acids comprises 38.8 wt % ± 5 % of neat sulfuric acid.

7. The composition of claim 1, wherein the one or more acids comprises 3.5 wt% ± 5 % of neat hydrochloric acid.

8. The composition of claim 1, wherein the one or more acids comprises sulfuric acid and hydrochloric acid.

9. The composition of claim 1, wherein the one or more acids comprises 38.8 wt % ± 5 % of neat sulfuric acid and of 3.5 wt% ± 5 % of neat hydrochloric acid.

10. The composition of claim 1, wherein the composition comprises water, 33.5 wt% ± 5 % to 50 wt% ± 5 % of neat sulfuric acid and 0.9 wt% ± 5 % of neat nitric acid.

11. The composition of claim 1, wherein the composition comprises water, 3.0 wt% ± 5 % to 5.0 wt% ± 5 % of neat hydrochloric acid and 0.6 wt% ± 5 % to 0.9 wt% ± 5 % of neat nitric acid.

12. The composition of claim 1, wherein the composition comprises water, 3.0 wt% ± 5 % to 5.0 wt% ± 5 % of neat hydrochloric acid, 0.6 wt% ± 5 % to 0.9 wt% ± 5 % of neat nitric acid and 40 wt% ± 5 % of methane sulfonic acid.

13. The composition of claim 1, wherein the composition comprises water and 40 wt% ± 5 % to 45 wt% ± 5 % combined of neat sulfuric acid, neat hydrochloric acid and neat nitric acid.

14. The composition of claim 1, wherein the composition comprises water and 43 wt% ± 5 % to 45 wt% ± 5 % combined of neat sulfuric acid, neat hydrochloric acid and neat nitric acid.

15. The composition of claim 1, wherein the composition comprises water, 38.8 wt % ± 5 % of neat sulfuric acid, 3.5 wt% ± 5 % of neat hydrochloric acid and 0.9 wt% ± 5 % of neat nitric acid.

16. The composition of claim 1, wherein the composition consists essentially of water, 38.8 wt % ± 5 % of neat sulfuric acid, 3.5 wt% ± 5 % of neat hydrochloric acid and 0.9 wt% ± 5 % of neat nitric acid.

17. The composition of claim 1, wherein the composition consists of water, 38.8 wt % ± 5 % of neat sulfuric acid, 3.5 wt% ± 5 % of neat hydrochloric acid and 0.9 wt% ± 5 % of neat nitric acid.

18. The composition of claim 1, wherein the one or more halogen ion source comprises one or more of hydrobromic acid, hydroiodic acid, hydrogen chloride, hydrochloric acid, ammonium chloride, ammonium bromide, and ammonium iodide.

19. The composition of claim 1, wherein the one or more halogen ion source comprises one or more of ammonium chloride, ammonium bromide, and ammonium iodide.

20. The composition of claim 1, wherein the composition has an Fe_2O_3 solubility of 2 mg/100 ml ± 5 % or greater to 11 mg/100 ml ± 5 % or greater.

21. A method of removing a metal-containing layer of a pellicle structure comprising the steps of:

a. providing a semiconductor device comprising a substrate, an EUV mask and a metal-containing EUV mask-protecting structure comprising nickel;

b. exposing the semiconductor device to EUV radiation; and

c. removing the metal-containing EUV mask-protecting structure by contacting said semiconductor device to the composition of claim 1.