CLAIMS

1. An etching solution suitable for the selective removal of polysilicon over silicon oxide from a microelectronic device, which comprises:

water;

0.5 wt% to 7 wt% neat of at least one quaternary ammonium hydroxide compound selected from the group of ethyltrimethyl ammonium hydroxide (ETMAH) and tetramethyl ammonium hydroxide (TMAH);

15 wt% to 20 wt% of at least one alkanolamine compound;

50 wt% to 59.5 wt% of at least one water-miscible organic solvent selected from the group consisting of ethylene glycol (EG) and propylene glycol (PG);

0.1 wt% to 3 wt% of at least one nitrogen containing compound selected from the group consisting of 8-hydroxyquinoline (8-HQ), 3,4-toluenediamine, 1-(2-aminoethyl) piperazine, 1H-pyrazole, 4-isopropylaniline, benzimidazole, 8-hydroxy-2-methylquinoline and pentamethyldiethylenetriamine (PMDETA); and

optionally, a surfactant;

wherein a total weight of components in the etching solution is 100% by weight.

2. The etching solution of claim 1, wherein the at least one quaternary ammonium hydroxide comprises 1 wt% of neat ethyltrimethyl ammonium hydroxide (ETMAH);

the at least one alkanolamine compound comprises 20 wt% of monoethanolamine (MEA); and

the at least one water-miscible organic solvent comprises 50 wt% to 59.5 wt% of ethylene glycol (EG).

3. The etching solution of claim 1, wherein the at least one of a quaternary ammonium hydroxide comprises 1 wt% neat of tetramethyl ammonium hydroxide (TMAH),

the at least one alkanolamine comprises 20 wt% of monoethanolamine (MEA), and

the at least one water-miscible organic solvent comprises 50 wt% to 59.5 wt% of ethylene glycol (EG).

4. The etching solution of claim 2, wherein the at least one water-miscible organic solvent comprises 55 wt% of ethylene glycol (EG).

5. The etching composition of claim 3, wherein the at least one water-miscible organic solvent comprises 55 wt% of ethylene glycol (EG).

6. The etching composition of claim 1, wherein the at least one nitrogen containing compound comprises 0.5 wt% of 8-hydroxyquinoline (8-HQ).

7. The etching composition of claim 2, wherein the at least one nitrogen containing compound comprises 0.5 wt% of 8-hydroxyquinoline (8-HQ).

8. The etching composition of claim 3, wherein the at least one nitrogen containing compound comprises 0.5 wt% of 8-hydroxyquinoline (8-HQ).

9. The etching composition of claim 1 comprising
water;
1 wt% neat of ethyltrimethyl ammonium hydroxide (ETMAH);
15 wt% to 20 wt% of monoethanolamine (MEA);
50 to 55 wt% of ethylene glycol (EG); and
0.5 wt% of 8-hydroxyquinoline (8-HQ);
wherein the total weight of components in the etching solution is 100% by weight.

10. The etching composition of claim 1 comprising:

water;

1 wt% neat of tetramethyl ammonium hydroxide (TMAH);

15 wt% to 20 wt% of monoethanolamine (MEA);

50 to 55 wt% of ethylene glycol (EG); and

0.5 wt% of 8-hydroxyquinoline (8-HQ);

wherein the total weight of components in the etching solution is 100% by weight.

11. A method for selectively enhancing the etch rate of polysilicon relative to silicon oxide in a composite semiconductor device comprising polysilicon and silicon oxide, the method comprising the steps of:

contacting the composite semiconductor device comprising polysilicon and silicon oxide with an aqueous composition according to any one of claims 1 to 10; and

rinsing the composite semiconductor device after the polysilicon is at least partially removed, wherein the selectivity of the etch for silicon over silicon oxide is greater than 1,000.

12. The method of claim 11 further comprising the step of drying the semiconductor device.

13. The method of claims 11 wherein the selectivity of the etch for silicon over silicon oxide is greater than 15,000.

14. The method of any of claims 11 wherein the selectivity of the etch for polysilicon over silicon oxide is greater than 20,000.

15. The method of any of claims 11 wherein the contacting step is performed at a temperature of from 25 °C to 100 °C.