Claims

1. A method for removing ruthenium and/or copper from a microelectronic device comprising ruthenium and/or copper and further comprising dielectrics, which comprises:

i) contacting the electronic device with a composition for a sufficient time under sufficient conditions to at least partially remove said ruthenium and/or copper from the microelectronic device, the composition comprising

(i) one or more heptavalent oxidants chosen from H_5IO_6 or HIO_4 ;

(ii) an alkylphosphonium hydroxide compound; and

(iii) water;

wherein said composition has a pH of about 9 to about 12.5, and

ii) etching the ruthenium and/or copper at an etch rate of greater than 20 Å/min while minimizing the etching of the dielectrics to an etch rate of less than 2 Å/min.

2. The method of claim 1, wherein the alkylphosphonium hydroxide compound is chosen from tetrabutylphosphonium hydroxide, tetramethylphosphonium hydroxide, tetraethylphosphonium hydroxide, tetrapropylphosphonium hydroxide, benzyltriphenylphosphonium hydroxide, methyl triphenylphosphonium hydroxide, ethyl triphenylphosphonium hydroxide, and n- propyl triphenylphosphonium hydroxide, and combinations thereof.

3. The method of claim 1, further comprising

(iv) a carbonate/bicarbonate buffering compound.

4. The method of claim 3, wherein the buffering compound is formed *in situ* by sparging the composition with carbon dioxide.

5. The method of claim 1, wherein component (i) is present in an amount of about 0.01 to 20 percent by weight; component (ii) is present in an amount of about 0.02 to 40 percent by weight; with the total of (i), (ii) component (iii) being 100 percent.

6. The method of claim 1, wherein component (i) is present in an amount of about 0.5 to 10 percent by weight; component (ii) is present in an amount of about 1 to 20 percent by weight; with the total of (i), (ii) component (iii) being 100 percent.

7. The method of claim 1, wherein component (i) is present in an amount of about 1 to 5 percent by weight; component (ii) is present in an amount of about 2 to 10 percent by weight; with the total of (i), (ii) component (iii) being 100 percent.

8. The method of claim 5, further comprising

(iv) a carbonate/bicarbonate buffering compound in an amount of about 0.01 to 5 weight percent, with the total of (i), (ii), (iii), and (iv) being 100 percent.

9. The method of claim 6, further comprising

(iv) a carbonate/bicarbonate buffering compound in an amount of about 0.1 to 2 weight percent, with the total of (i), (ii), (iii), and (iv) being 100 percent.

10. The method of claim 7, further comprising

(iv) a carbonate/bicarbonate buffering compound in an amount of about 0.2 to 1 weight percent, with the total of (i), (ii), (iii), and (iv) being 100 percent.

11. The method of claim 1, wherein the oxidant is H_5IO_6.

12. The method of claim 1, wherein the oxidant is HIO_4.

13. The method of claim 1, further comprising at least one corrosion inhibitor.

14. A method for removing ruthenium and/or copper from a microelectronic device comprising ruthenium and/or copper and further comprising dielectrics, which comprises:
i) contacting the electronic device with a composition for a sufficient time under sufficient conditions to at least partially remove said ruthenium and/or copper from the microelectronic device, the composition comprising

(i) one or more heptavalent oxidants chosen from H_5IO_6 or HIO_4,

(ii) an alkylammonium hydroxide compound, and

(iii) water,

wherein said composition has a pH of about 10.5 to about 12.2 and wherein said composition has an excess of (ii) relative to (i) and

ii) etching ruthenium and/or copper at an etch rate of greater than 20 Å/min while minimizing the etching of dielectrics to an etch rate of less than 2 Å/min.

15. The method of claim 14, wherein the alkylammonium compound is chosen from tetramethylammonium hydroxide, tetraethylammonium hydroxide, tetrapropylammonium hydroxide, tetrabutylammonium hydroxide, tributylmethylammonium hydroxide, benzyltrimethylammonium hydroxide, choline hydroxide, ethyltrimethylammonium hydroxide, tris(2-hydroxyethyl)methyl ammonium hydroxide, diethyldimethylammonium hydroxide, and combinations thereof.

16. The method of claim 15, wherein the alkylammonium compound is tetramethylammonium hydroxide.

17. The method of claim 14, further comprising

(iv) a carbonate/bicarbonate buffering compound.