CLAIMS

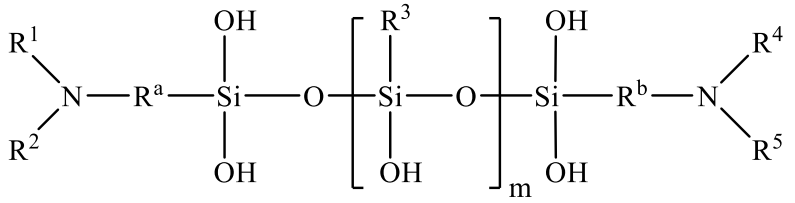
What is claimed is:

1. A composition comprising:

A. neat phosphoric acid;

B. approximately 30% or greater by weight of a mixture comprising at least one of:

I. a compound of Formula I:



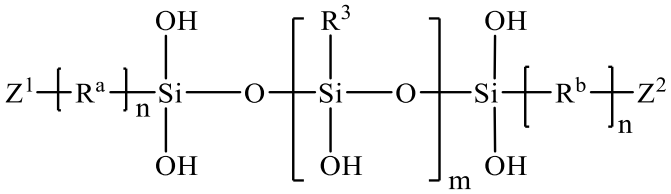
wherein:

(i) m = 0-20,

(ii) each of R^1, R^2, R^3, R^4 and R^5 is independently selected from the group of hydrogen, a C_1 to C_{10} linear alkyl group, a C_1 to C_{10} linear alkyl group substituted with a nitrogen-containing group, an oxygen-containing group, a C_3 to C_{10} branched alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_5 to C_{12} aryl group, a C_2 to C_{10} linear or branched alkenyl group and a C_2 to C_{10} linear or branched alkynyl group, –≀–OH, and

(iii) each of R^a and R^b is independently selected from a C_1 to C_{10} linear alkyl group, a C_3 to C_{10} branched alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_5 to C_{12} aryl group, a C_2 to C_{10} linear or branched alkenyl group and a C_2 to C_{10} linear or branched alkynyl group, –≀–NH-C_1-C_{10} alkyl, a C_1-C_{10} alkyl substituted with –≀–OH; or

II. a compound of Formula II:



wherein:

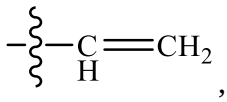
(i) m = 0-20,

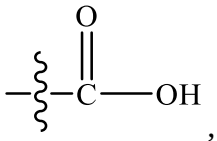
(ii) n =0-20,

(iii) R^3 is selected from the group of hydrogen, a C_1 to C_{10} linear alkyl group, a C_1 to C_{10} linear alkyl group substituted with a nitrogen-containing group, an oxygen-containing group, a C_3 to C_{10} branched alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_5 to C_{12} aryl group, a C_2 to C_{10} linear or branched alkenyl group and a C_2 to C_{10} linear or branched alkynyl group, –⦚–OH, Z^1 and Z^2, and

(iv) each of R^a and R^b is independently selected from a C_1 to C_{10} linear alkyl group, a C_3 to C_{10} branched alkyl group, a C_3 to C_{10} cyclic alkyl group, a C_5 to C_{12} aryl group, a C_2 to C_{10} linear or branched alkenyl group and a C_2 to C_{10} linear or branched alkynyl group, –⦚–NH-C_1-C_{10} alkyl, a C_1-C_{10} alkyl substituted with –⦚–OH,

(v) Z^1 and Z^2 are each independently selected from:

a. ,

b. ,

c. –⦚–$N^+(CH_3)_3Cl^-$, and

d. –⦚–$CH(OH)CH_2OH$; and

III. an aqueous solvent,

wherein the neat phosphoric acid is present at approximately 70% or less by weight of the composition, and

wherein the composition is substantially free of fluoride ions and ammonium ions.

2. The composition of claim 1, wherein the mixture further comprises at least one additional acid other than neat phosphoric acid selected from HNO_3, H_2SO_4, HCl and methane sulfuric acid.

3. The composition of claim 1, wherein (i) the mixture further comprises neat sulfuric acid and (ii) a combined content of the neat phosphoric acid and the neat sulfuric acid is between approximately 80% and approximately 85% by weight of the composition.

4. The composition of claim 1, wherein (i) the mixture further comprises sulfuric acid and (ii) a combined content of the neat phosphoric acid and the neat sulfuric acid is approximately 83.5% by weight of the composition.

5. The composition of claim 1, wherein the mixture further comprises one or more additional silicon-containing compound selected from alkylsilsesquioxanes, vinylsilsesquioxane, carboxylic acid alkylsilsesquioxane and alkyleneglycol alkylsilsesquioxane.

6. The composition of claim 1, wherein the mixture comprises a compound of Formula I and the aqueous solvent.

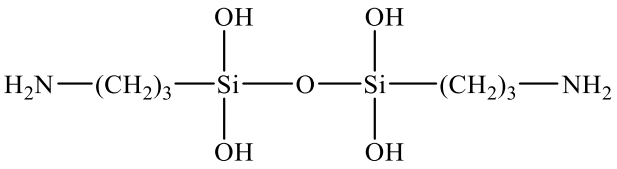
7. The composition of claim 1, wherein the mixture comprises a compound of Formula II.

8. The composition of claim 1, wherein m in one or both of Formula I and Formula II is 0.

9. The composition of claim 1, wherein a content of the compound of Formula I is approximately 5% or less by weight.

10. The composition of claim 1, comprising a compound of Formula I, wherein

(i) the compound of Formula I comprises:



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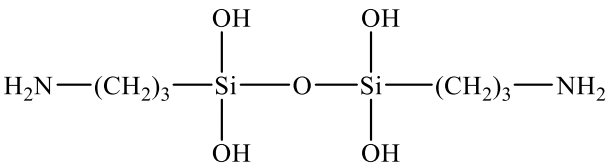
11. The composition of claim 1, comprising a compound of Formula I, wherein

(i) the compound of Formula I comprises:

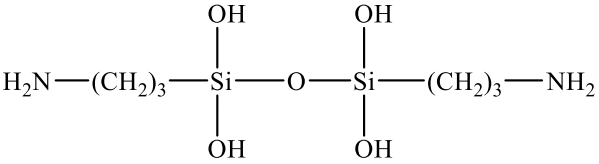


(ii) the mixture further comprises neat sulfuric acid, and

(iii) a combined content of the neat phosphoric acid and the neat sulfuric acid is between approximately 80% and approximately 85% by weight of the composition.

12. The composition of claim 1, comprising a compound of Formula I, wherein

(i) the compound of Formula I comprises:

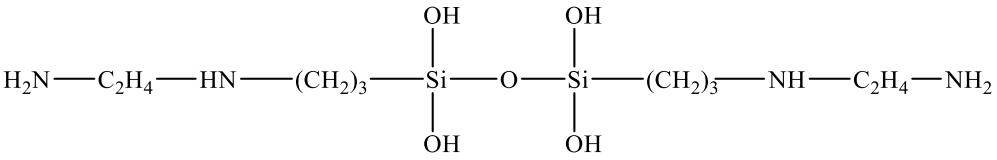


(ii) the mixture further comprises sulfuric acid, and

(iii) a combined content of the neat phosphoric acid and the neat sulfuric acid is approximately 83.5% by weight of the composition.

13. The composition of claim 1, comprising a compound of Formula I, wherein

(i) the compound of Formula I comprises:



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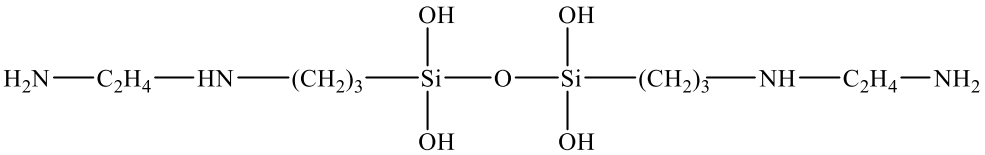
14. The composition of claim 1, comprising a compound of Formula I, wherein

(i) the compound of Formula I comprises:



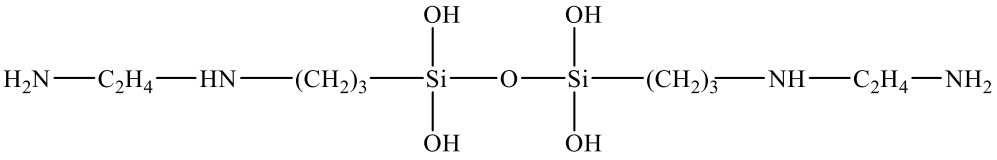
,

(ii) the mixture further comprises neat sulfuric acid, and

(iii) a combined content of the neat phosphoric acid and the neat sulfuric acid is between approximately 80% and approximately 85% by weight of the composition.

15. The composition of claim 1, comprising a compound of Formula I, wherein

(i) the compound of Formula I comprises:



,

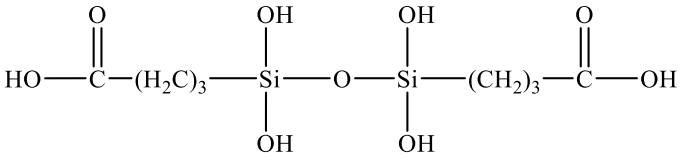
(ii) the mixture further comprises sulfuric acid, and

(iii) a combined content of the neat phosphoric acid and the neat sulfuric acid is approximately 83.5% by weight of the composition.

16 The composition of claim 1, wherein a content of the compound of Formula II is approximately 5% or less by weight.

17. The composition of claim 1, comprising a compound of Formula II, wherein

(i) the compound of Formula II comprises:



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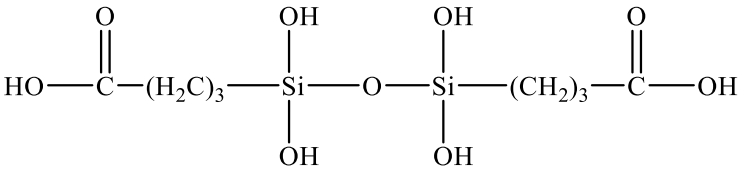
18. The composition of claim 1, comprising a compound of Formula II, wherein

(i) the compound of Formula II comprises:



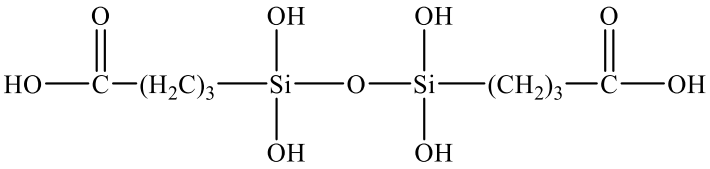
,

(ii) the mixture further comprises neat sulfuric acid, and

(iii) a combined content of the neat phosphoric acid and the neat sulfuric acid is between approximately 80% and approximately 85% by weight of the composition.

19. The composition of claim 1, comprising a compound of Formula II, wherein

(i) the compound of Formula II comprises:



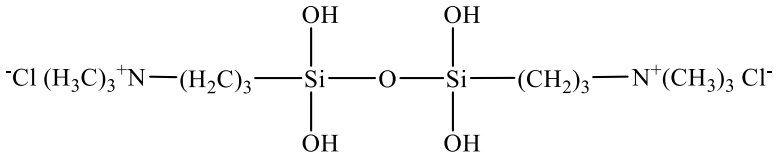
,

(ii) the mixture further comprises sulfuric acid, and

(iii) a combined content of the neat phosphoric acid and the neat sulfuric acid is approximately 83.5% by weight of the composition.

20. The composition of claim 1, comprising a compound of Formula II, wherein

(i) the compound of Formula II comprises:



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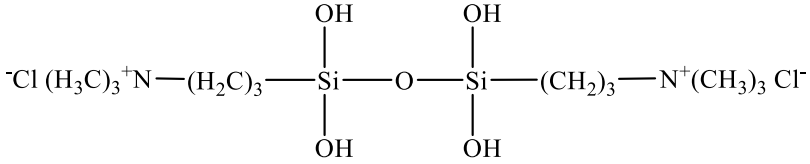
21. The composition of claim 1, comprising a compound of Formula II, wherein

(i) the compound of Formula II comprises:



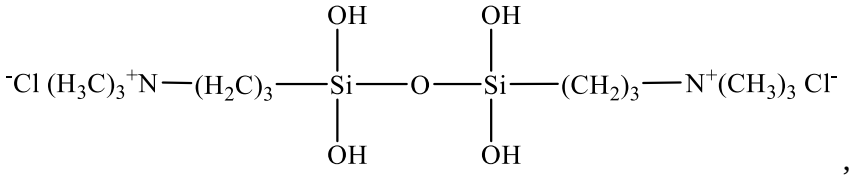
,

(ii) the mixture further comprises neat sulfuric acid, and

(iii) a combined content of the neat phosphoric acid and the neat sulfuric acid is between approximately 80% and approximately 85% by weight of the composition.

22. The composition of claim 1, comprising a compound of Formula II, wherein

(i) the compound of Formula II comprises:



,

(ii) the mixture further comprises sulfuric acid, and

(iii) a combined content of the neat phosphoric acid and the neat sulfuric acid is approximately 83.5% by weight of the composition.

23. A method of selectively enhancing the etch rate of silicon nitride relative to silicon dioxide on a semiconductor substrate comprising silicon nitride and silicon dioxide, the method comprising the steps of:

a. contacting the semiconductor substrate comprising silicon nitride and silicon dioxide with the composition of claim 1; and

b. rinsing the semiconductor device after the silicon nitride is at least partially removed.