CLAIMS

1. A chemical-mechanical polishing composition suitable for polishing a silicon nitride-containing substrate while suppressing polysilicon removal from the substrate, the composition comprising 0.01 to 15 percent by weight abrasive particles suspended in an aqueous carrier containing 10 to 10,000 ppm of a surfactant comprising an alkyne diol, an alkyne diol ethoxylate, or a combination thereof.

2. The composition of claim 1 wherein the aqueous carrier has a pH up to 10.

3. The composition of claim 1 wherein the aqueous carrier has a pH in the range of 1 to 4.

4. The composition of claim 1 wherein the abrasive particles comprise colloidal silica.

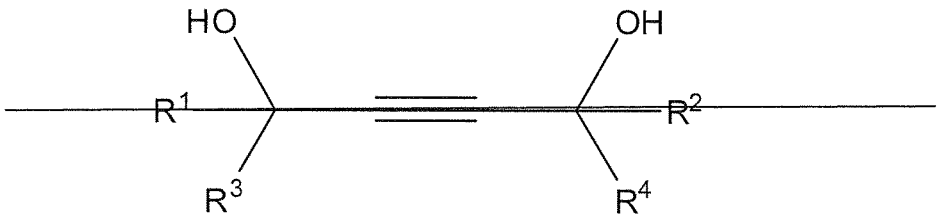
5. The composition of claim 1 further comprising 10 to 100,000 ppm of at least one carboxylic acid-containing additive.

6. The composition of claim 5 wherein the at least one carboxylic acid-containing additive comprises malonic acid, glycine, or a combination thereof.

7. The composition of claim 1 wherein the surfactant is present at a concentration in the range of 20 to 1,000 ppm.

8. The composition of claim 1 wherein the surfactant comprises an alkyne diol compound of Formula (I) and/or an ethoxylate thereof comprising 1 to 40 moles of ethyleneoxy units per mole of alkyne diol compound;

Formula (I):




wherein

each of $R^1$ and $R^2$ is independently H or methyl; and

each of $R^3$ and $R^4$ is independently a $C_1$ to $C_{22}$ alkyl group.

~~9. The composition of claim 1 further comprising an organic or inorganic salt additive.~~

~~10. The composition of claim 9 wherein the salt additive comprises potassium sulfate.~~

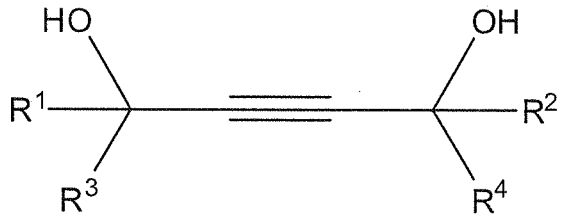
CLAIMS

~~1~~1. A method of polishing a semiconductor substrate to remove silicon nitride in preference to polysilicon from the surface of the substrate; the method comprising abrading a surface of a silicon nitride- and polysilicon-containing substrate with a CMP composition comprising 0.01 to 15 percent by weight abrasive particles suspended in an aqueous carrier containing 10 to 10,000 ppm of a surfactant comprising an alkyne-diol, an alkyne diol ethoxylate, or a combination thereof, the composition further comprises an additive comprising potassium sulfate wherein the aqueous carrier has a pH in the range of about 1 to about 4.

~~1~~2. The method of claim ~~1~~1 wherein the polishing is performed in the presence of hydrogen peroxide.

~~1~~3. The method of claim ~~1~~1 wherein the surfactant in the CMP composition comprises an alkyne diol compound of Formula (I) and/or an ethoxylate thereof comprising 1 to 40 moles of ethyleneoxy units per mole of alkyne diol compound;

Formula (I):




wherein

each of $R^1$ and $R^2$ is independently H or methyl; and

each of $R^3$ and $R^4$ is independently a $C_1$ to $C_{22}$ alkyl group.

~~1~~4. The method of claim ~~1~~1 wherein the abrading is accomplished by:

(a) contacting a surface of the substrate with a polishing pad and the CMP composition; and

(b) causing relative motion between the polishing pad and the substrate while maintaining a portion of the CMP composition in contact with the surface between the pad and the substrate for a time period sufficient to abrade silicon nitride from the surface.

~~1~~5. The method of claim ~~1~~1 wherein the composition further comprises 10 to 100,000 ppm of at least one carboxylic acid-containing additive.

~~1~~6. The method of claim ~~1~~5 wherein the at least one carboxylic acid-containing additive comprises malonic acid, glycine, or a combination thereof.

~~17. The method of claim 11 wherein the composition further comprises an organic or inorganic salt additive.~~

~~18. The method of claim 17 wherein the salt additive comprises potassium sulfate.~~

~~19. The method of claim 11 wherein the aqueous carrier has a pH up to 10.~~

~~20. The method of claim 19 wherein the aqueous carrier has a pH in the range of 1 to 4.~~