~~We~~ Claim:

1. An aqueous cleaning solution effective for removing sidewall polymer produced during a damascene process on a wafer containing one or more metallic interconnect materials and one or more low-k interlayer dielectric material films, the cleaning solution comprising:

0.01 to 0.1 w/w% of hydrofluoric acid,

1 to 5 w/w% of sulfuric acid,

1 to 15 w/w% of a carboxylic acid,

up to 2 w/w% of one or more species of chelating agent,

up to 15 w/w% of one or more species of amine, and

75 w/w% or more of water;

wherein the cleaning solution does not damage the one or more low-k interlayer dielectric material films,

wherein the cleaning solution is free of nitric acid, and

wherein the carboxylic acid is malic acid, or iminodiacetic acid.

~~2. The cleaning solution of claim 1, wherein the carboxylic acid is oxalic acid, malic acid, or iminodiacetic acid.~~

~~3~~2. The cleaning solution of claim 1, wherein the carboxylic acid is 1 to 15% oxalic acid, 1 to 15% malic acid, or 1 to 10% iminodiacetic acid.

~~4~~3. The cleaning solution of claim 1, wherein the carboxylic acid is 4 to 11% oxalic acid, 4 to 11% malic acid, or 2 to 6% iminodiacetic acid.

~~5~~4. The cleaning solution of claim 1, wherein the chelating agent is ammonium fluoride, ammonium hydrogen fluoride, and/or ethylenediaminetetraacetic acid.

~~6~~5. The cleaning solution of claim 1, comprising an effective amount of the chelating agent, wherein the chelating agent is 0.01 to 0.2% ammonium fluoride, 0.9 to 1.1% ammonium hydrogen fluoride, and/or 0.1 to 0.3% ethylenediaminetetraacetic acid.

~~7~~6. The cleaning solution of claim 1, wherein the amine is 4 to 11 % triethanolamine.

~~8~~7. The cleaning solution of claim 1, wherein a concentration of the carboxylic acid is equal to or higher than a concentration of sulfuric acid.

~~9~~8. The cleaning solution of claim 1, wherein a concentration ratio of the carboxylic acid to the chelating agent is at least 10:1.

~~10~~9. The cleaning solution of claim 1, wherein a concentration ratio of the sulfuric acid to the chelating agent is at least 10: 1.

~~11~~10. The cleaning solution of claim 1, wherein the cleaning solution is free of alcohols, peroxides and esters.

~~12~~11. The cleaning solution of claim 1, wherein the cleaning solution is free of hydrogen peroxide.

~~13~~12. The cleaning solution of claim 1, wherein the cleaning solution is free of ammonia.

~~14~~13. The cleaning solution of claim 1, wherein the cleaning solution is free of ammonium hydroxide.

~~15~~14. The cleaning solution of claim 1, wherein the cleaning solution is free of the one or more species of chelating agent.

~~16~~15. The cleaning solution of claim 1, wherein the cleaning solution is free of the one or more species of amine.

~~17~~16. The cleaning solution of claim 1, wherein the cleaning solution is free of nitric acid.

~~18~~17. The cleaning solution of claim 1, wherein the cleaning solution is free of the one or more species of surfactant.

~~19~~18. A method of using the cleaning solution of claim 1 for removing sidewall polymer on plasma etched features produced during a damascene process on a wafer containing one or more metallic interconnect materials and one or more low-k interlayer dielectric material films, the method comprising immersing the wafer in the cleaning solution maintained at a temperature from 30 to 70°C for up to 40 seconds, the cleaning solution effectively removing the sidewall polymer with minimal damage to the metallic interconnect materials and the one or more low-k interlayer dielectric material films.

~~20~~19. The method of claim ~~19~~18, wherein the wafer is immersed in the cleaning solution for 8 to 30 seconds.

20. The cleaning solution of claim 1, wherein the carboxylic acid is iminodiacetic acid in an amount of 1 to 10 w/w%.

21. The cleaning solution of claim 20, wherein the chelating agent is ammonium fluoride in an amount of 0.01 to 0.2 w/w%.

22. An aqueous cleaning solution effective for removing sidewall polymer produced during a damascene process on a wafer containing one or more metallic interconnect materials and one or more low-k interlayer dielectric material films, the cleaning solution comprising:

0.01 to 0.1 w/w% of hydrofluoric acid,

1 to 5 w/w% of sulfuric acid,

1 to 15 w/w% of a carboxylic acid,

up to 2 w/w% of one or more species of chelating agent,

up to 15 w/w% of one or more species of amine, and

75 w/w% or more of water;

wherein the cleaning solution does not damage the one or more low-k interlayer dielectric material films,

wherein the carboxylic acid is 1 to 15% malic acid, or 1 to 10% iminodiacetic acid,

wherein the chelating agent is ammonium fluoride, ammonium hydrogen fluoride, and/or ethylenediaminetetraacetic acid,

wherein a concentration of the carboxylic acid is equal to or higher than a concentration of sulfuric acid,

wherein a concentration ratio of the carboxylic acid to the chelating agent is at least 10: 1,

wherein a concentration ratio of the sulfuric acid to the chelating agent is at least 10: 1, and

wherein the cleaning solution is free of nitric acid.

23. An aqueous cleaning solution effective for removing sidewall polymer produced during a damascene process on a wafer containing one or more metallic interconnect materials and one or more low-k interlayer dielectric material films, the cleaning solution comprising:

0.01 to 0.1 w/w% of hydrofluoric acid,

1 to 5 w/w% of sulfuric acid,

1 to 15 w/w% of a carboxylic acid,

up to 2 w/w% of one or more species of chelating agent,

up to 15 w/w% of one or more species of amine, and

75 w/w% or more of water;

wherein the cleaning solution does not damage the one or more low-k interlayer dielectric material films,

wherein the carboxylic acid is 1 to 15% malic acid, or 1 to 10% iminodiacetic acid,

wherein the chelating agent is ammonium fluoride, ammonium hydrogen fluoride, and/or ethylenediaminetetraacetic acid, and

wherein the cleaning solution is free of hydrogen peroxide, ammonia, ammonium hydroxide, amine, and nitric acid.