CLAIMS

1. An etching composition comprising:

potassium hydroxide;

one or more than one additional alkaline compounds selected from the group consisting of tetraethylammonium hydroxide (TEAH), tetramethylammonium fluoride (TMAF) and NH_4OH; and

water;

wherein the composition preferentially etches silicon present on a substrate as compared to silicon dioxide present on said substrate.

2. An etching composition comprising:

~~one~~ two or more ~~than one~~ inorganic alkali basic hydroxides selected from the group consisting of potassium hydroxide, cesium hydroxide, sodium hydroxide, rubidium hydroxide, or lithium hydroxide; wherein the two or more inorganic alkali basic hydroxides comprise potassium hydroxide and cesium hydroxide,

optionally one or more than one additional alkaline compounds;

optionally one or more corrosion inhibitors; and

water;

wherein the composition preferentially etches silicon present on a substrate as compared to silicon dioxide present on said substrate.

3. The etchant composition of claim 2 wherein ~~the one or more inorganic alkali basic hydroxides are selected from the group consisting of potassium hydroxide and cesium hydroxide~~ said inorganic alkali basic hydroxides are present in a total amount of from 0.5 to 25 wt % of the total composition.

~~4. The etchant composition of claim 2 wherein the one or more inorganic alkali basic hydroxides comprise potassium hydroxide and cesium hydroxide.~~

~~5~~4. The etchant composition of claim 2 wherein the one or more inorganic alkali basic hydroxides comprise potassium hydroxide and lithium hydroxide.

~~6~~5. The etchant composition of claim 2 wherein the one or more than one additional alkaline compounds are present in the composition and are selected from the group consisting of one or more quaternary ammonium hydroxides, quaternary ammonium fluorides or ammonium hydroxide (NH_4OH).

~~7~~6. The etchant composition of claim 2 wherein the one or more than one additional alkaline compound are present in the composition and are selected from the group consisting of quaternary ammonium compounds or one or more additional alkaline compounds are selected from the group consisting of tetramethylammonium hydroxide (TMAH), tetraethylammonium hydroxide (TEAH), tetrabutylammonium hydroxide (TBAH), tetrapropylammonium hydroxide, trimethylethylammonium hydroxide, (2-hydroxyethyl)trimethylammonium hydroxide, (2-hydroxyethyl)triethylammonium hydroxide, (2-hydroxyethyl)tripropylammonium hydroxide, (1-hydroxypropyl)trimethylammonium hydroxide, ethyltrimethylammonium hydroxide (ETMAH), diethyldimethylammonium hydroxide, benzyltrimethylammonium hydroxide, choline hydroxide, tetramethylammonium fluoride (TMAF), tetraethylammonium fluoride, tetrabutylammonium fluoride (TBAF), tetrapropylammonium fluoride, trimethylethylammonium fluoride, (2-hydroxyethyl)trimethylammonium fluoride, (2-hydroxyethyl)triethylammonium fluoride, (2-hydroxyethyl)tripropylammonium fluoride, (1-hydroxypropyl)trimethylammonium fluoride, ethyltrimethylammonium fluoride, diethyldimethylammonium fluoride and benzyltrimethylammonium fluoride.

8~~7~~. The etchant composition of claim ~~2~~ 6 wherein the one or more than one quaternary ammonium compounds or one or more additional alkaline compounds are selected from the group consisting of tetramethyl ammonium hydroxide (TMAH), tetraethylammonium hydroxide (TEAH), ethyltrimethylammonium hydroxide (ETMAH), dimethyldipropylammonium hydroxide (DMDPAH), tetramethylammonium fluoride (TMAF), choline hydroxide and benzyltrimethylammonium hydroxide.

~~9~~8. The etchant composition of claim 2 wherein the one or more additional alkaline compounds are selected from the group consisting of tetraethylammonium hydroxide (TEAH), ethyltrimethylammonium hydroxide (ETMAH), dimethyldipropylammonium hydroxide (DMDPAH), tetramethylammonium fluoride (TMAF) ammonium hydroxide (NH_4OH), choline hydroxide and benzyltrimethylammonium hydroxide.

~~10~~9. The etchant composition of claim 2 wherein the one or more additional alkaline compounds are selected from tetraethylammonium hydroxide (TEAH),

ethyltrimethylammonium hydroxide (ETMAH), dimethyldipropylammonium hydroxide (DMDPAH), choline hydroxide and benzyltrimethylammonium hydroxide.

~~11~~10. The etchant composition of claim 2 wherein the ~~one~~ two or more inorganic alkali basic hydroxides are present in a total amount of from ~~0.5 to 25~~1 to 20 wt % of the total composition.

~~12~~11. The etchant composition of claim 2 wherein the ~~one~~ two or more inorganic alkali basic hydroxides are present in a total amount of from 1 to ~~20~~ 14 wt % of the total composition.

~~13~~12. The etchant composition of claim 2 wherein the one or more corrosion inhibitors are present in the composition and the one or more corrosion inhibitors are selected from the group consisting of anthranilic acid, gallic acid, benzoic acid, isophthalic acid, maleic acid, fumaric acid, D,L-malic acid, malonic acid, phthalic acid, ascorbic acid, maleic anhydride, phthalic anhydride, benzotriazole (BZT), resorcinol, carboxybenzotriazole, lactic acid, citric acid, catechol, t-butyl catechol, pyrogallol, esters of gallic acid, phenol, glycine, tetramethylguanidine, iminodiacetic acid, and dimethylacetoacetamide, trihydroxybenzene, dihydroxybenzene, and salicylhydroxamic acid.

~~14~~13. The etchant composition of claim 2 wherein the one or more corrosion inhibitors are present in the composition and the one or more corrosion inhibitors are selected from the group consisting of catechol, t-butyl catechol, pyrogallol, gallic acid and phenol.

~~15~~14. The etchant composition of claim 2 wherein the one or more corrosion inhibitors are present in the composition and the one or more corrosion inhibitors are selected from the group consisting of catechol and t-butyl catechol.

~~16~~15. The etchant composition of claim 2 wherein the one or more additional alkaline compounds are present in the composition from 0.1 to 5 wt %.

~~17~~16. The etchant composition of claim ~~11~~10 wherein the one or more additional alkaline compounds are present in the composition from 0.2 to 3 wt %.

~~18~~17. The etchant composition of claim ~~16~~15 wherein the composition comprises from 70 to 99 wt% water based on the total weight of the composition.

~~19~~18. The etchant composition of claim 2 wherein the composition comprises from 80 to 98 wt% water based on the total weight of the composition.

~~20~~19. The etchant composition of claim 2 wherein the composition is substantially free or free of one or more or all of the following: surfactants, chelating agents, oxidizing agents, organic solvents and biocides.

~~21~~20. A method of producing a silicon substrate, the method comprising: forming a silicon dioxide film on a silicon substrate, said silicon dioxide film having at least one opening in said silicon dioxide film on at least one surface of the silicon substrate; a first etching step for etching the silicon substrate at the at least one opening by using the composition of claim 1 whereby said silicon dioxide film acts as a mask, wherein said first etching step is used to form a through silicon via.

~~22~~21. The method of claim ~~21~~20 further comprising the step of layering a titanium nitride film on the silicon dioxide film, said titanium nitride film also formed with at least one opening, at least one of said at least one titanium nitride opening and at least one of said at least one silicon dioxide opening being aligned.

~~23~~22. The method of claim ~~21~~20 further comprising prior to the first etching step, a second etching step to form one or more holes in said silicon substrate wherein said one or more holes do not protrude through the surface of the silicon substrate; and wherein during said first etching step said one or more holes are aligned with the at least one opening in said silicon dioxide film formed on said silicon substrate.

~~24~~23. A method according to claim ~~21~~20 further comprising the step of filling the one or more holes with copper before or after the first etching step ~~or after the second etching step~~.

24. A method according to claim 22 further comprising the step of filling the one or more holes with copper after the second etching step.

25. A method of producing a silicon substrate, the method comprising: forming a silicon dioxide film on a silicon substrate, said silicon dioxide film having at least one opening in said

silicon dioxide film on at least one surface of the silicon substrate; a first etching step for etching the silicon substrate at the at least one opening by using the composition of claim 2 whereby said silicon dioxide film acts as a mask, wherein said first etching step is used to form a through silicon via.