Thus, conventional etching solution compositions have difficulties in reducing the deposition of silica on the surface of silicon oxide while increasing the etch rate of silicon nitride. There is still room for improvement in etching solution compositions.

[0011]

With the above problems in mind, the present invention has been made. It is an object of the present invention to provide an etching solution composition that is capable of providing both a higher etch selectivity of silicon nitride and a reduction in the deposition of silica on the surface of silicon oxide.

SOLUTION TO PROBLEM

[0012]

A characteristic feature of an etching solution composition according to the present invention for solving the above problem is an inorganic acid-based etching solution composition for selectively etching away silicon nitride from a semiconductor containing silicon nitride and silicon oxide, the etching solution composition comprising:

(a) an etch inhibitor that reduces etching of silicon oxide; and

(b) a deposition inhibitor that reduces deposition of silica on a surface of silicon oxide, whrein the etch inhibitor contains an alkoxysilane or a silane coupling agent, and the deposition inhibitor contains a hydrazide.

[0013]

With the etching solution composition thus configured, silicon nitride is mainly etched by the inorganic acid while the etch inhibitor reduces the etching of silicon oxide by water, resulting in an improvement in the etch selectivity of silicon nitride in the semiconductor containing silicon nitride and silicon oxide. In addition, the deposition inhibitor can reduce the deposition of silica on the surface of silicon oxide, resulting in a reduction in the occurrence of defects such as short circuits and defective interconnections in semiconductor products.

[0014]

[0015]

The etching solution composition thus configured contains a preferable etch inhibitor and deposition inhibitor, and therefore, can have both the effect of reducing the etching of silicon oxide by the etch inhibitor and the effect of reducing the deposition of silica on the surface of silicon oxide by the deposition inhibitor, resulting in an improvement in the etch selectivity of silicon nitride.

[0016]

CLAIMS

1. An inorganic acid-based etching solution composition for selectively etching away silicon nitride from a semiconductor containing silicon nitride and silicon oxide, the etching solution composition comprising:

(a) an etch inhibitor that reduces etching of silicon oxide; and

(b) a deposition inhibitor that reduces deposition of silica on a surface of silicon oxide,

wherein

the etch inhibitor contains an alkoxysilane or a silane coupling agent, and

the deposition inhibitor contains a hydrazide.

2. The etching solution composition according to claim 1, wherein

the alkoxysilane includes dimethyldimethoxysilane, and

the silane coupling agent includes N-2-(aminoethyl)-3-aminopropyltrimethoxysilane or 3-aminopropyltrimethoxysilane.

3. The etching solution composition according to claim 1 or 2, wherein

the hydrazide includes adipic acid dihydrazide, acetohydrazide, succinic acid dihydrazide, or dodecanedioic acid dihydrazide.

4. The etching solution composition according to any one of claims 1 to 3, wherein

the deposition inhibitor further includes a compound having an imidazole backbone, a compound having a pyrrolidine backbone, a phosphonic acid compound, or a compound having a quaternary ammonium backbone.

5. The etching solution composition according to claim 4, wherein

the compound having an imidazole backbone includes imidazole, 1-butyl-3-methylimidazolium chloride, 1-ethyl-3-methylimidazolium hexafluorophosphate, or 1-ethyl-3-octylimidazolium tetrafluoroborate,

the compound having a pyrrolidine backbone includes 1-butyl-1-methylpyrrolidinium hexafluorophosphate or 1-butyl-1-methylpyrrolidinium tetrafluoroborate,

the phosphonic acid compound includes tetrabutylphosphonium bromide, and

the compound having a quaternary ammonium backbone includes tetramethylammonium hexafluorophosphate.

6. The etching solution composition according to any one of claims 1 to 5, wherein

the etching solution composition can be used until the concentration of Si derived from silicon nitride in the

solution reaches 1000 ppm.

7. The etching solution composition according to any one of claims 1 to 6, wherein

a selectivity ratio [R_1/R_2] of a silicon nitride etch rate [R_1] to a silicon oxide etch rate [R_2] is at least two times as high as that of an etching solution containing only the inorganic acid.