Accordingly, in a first aspect there is provided a CMP composition which comprises

(A) inorganic particles, organic particles, or a mixture or composite thereof,

(B) a protein comprising cysteine as amino acid unit, and

(C) an aqueous medium.

In a second aspect there is provided a process for the manufacture of a semiconductor device comprising the polishing of a substrate in the presence of said CMP composition as defined above.

In a third aspect there is provided the use of the CMP composition as defined above for chemical mechanical polishing of substrates which are used in the semiconductor industry, which fulfills the objects of the embodiments of the present disclosure.

Preferred embodiments are explained in the claims and the specification. It is understood that combinations of preferred embodiments are within the scope of the present disclosure.

A semiconductor device can be manufactured by a process which comprises the CMP of a substrate in the presence of the CMP composition of the invention. Preferably, said process comprises the CMP of a dielectric substrate, that is a substrate having a dielectric constant of less than 6. Said process comprises more preferably the CMP of a substrate comprising silicon dioxide, most preferably the CMP of a substrate comprising silicon dioxide and silicon nitride or polysilicon, particularly the CMP of a silicon dioxide layer of a substrate which is a shallow trench isolation (STI) device or a part thereof, for example the CMP of a silicon dioxide layer of a substrate comprising silicon dioxide and silicon nitride or polysilicon.

If said process comprises the CMP of a substrate comprising silicon dioxide and silicon nitride, the selectivity of silicon dioxide to silicon nitride with regard to the material removal rate is preferably higher than 20:1, more preferably higher than 35:1, most preferably higher than 50:1, particularly higher than 70:1, for example higher than 90:1. This selectivity can be adjusted by the type and concentration of protein (B) and by setting other parameters such as pH value.

If said process comprises the CMP of a substrate comprising silicon dioxide and polysilicon, the selectivity of silicon dioxide to polysilicon with regard to the material removal rate is preferably higher than 20:1, more preferably higher than 35:1, most preferably higher than 50:1, particularly higher than 70:1, for example higher than 90:1. This selectivity can be adjusted by the type and concentration of protein (B) and by setting other parameters such as pH value.

The CMP composition of the invention is used for polishing any substrate used in the semiconductor industry. Said CMP composition is used preferably for polishing a dielectric substrate, that is a substrate having a dielectric constant of less than 6, more preferably for polishing a substrate comprising silicon dioxide, most preferably for polishing a substrate comprising silicon dioxide and silicon nitride or polysilicon, particularly for polishing a silicon dioxide layer of a substrate which is a shallow trench isolation (STI) device or a part thereof, and for example for pol-

Claims:

1. A chemical mechanical polishing (CMP) composition comprising

(A) inorganic particles, organic particles, or a mixture or composite thereof,

(B) a protein comprising cysteine as amino acid unit, and

(C) an aqueous medium.

~~2. The CMP composition according to claim 1, wherein the protein (B) is a protein comprising cysteine as amino acid unit.~~

~~3.~~2. The CMP composition according to claim 1 ~~or 2~~, wherein the protein (B) is a fungal protein.

~~4.~~3. The CMP composition according to anyone of the claims 1 to ~~2~~3, wherein the protein (B) is a protein comprising more than 100 amino acid units.

~~5.~~4. The CMP composition according to anyone of the claims 1 to ~~3~~4, wherein the protein (B) is hydrophobin or comprises at least one hydrophobin unit.

~~6.~~5. The CMP composition according to anyone of the claims 1 to ~~4~~5, wherein the particles (A) are ceria particles.

~~7.~~6. The CMP composition according to anyone of the claims 1 to ~~5~~6, wherein the mean particle size of the particles (A) is from 50 nm to 300 nm, as determined by dynamic light scattering techniques.

~~8.~~7. The CMP composition according to anyone of the claims 1 to ~~6~~7, further comprising

(H) a sugar compound.

~~9.~~8. The CMP composition according to anyone of the claims 1 to ~~7~~8, ~~further comprising~~ wherein the sugar compound (H) is selected from the group consisting of mono-, di-, tri-, tetra-, penta-, oligo- and polysaccharides, and oxidized monosaccharides.

~~(H) a sugar compound selected from the group consisting of mono-, di-, tri-, tetra-, penta-, oligo- and polysaccharides, and oxidized monosaccharides.~~

~~10.~~9. The CMP composition according to anyone of the claims 1 to ~~8~~9, wherein the sugar compound (H) is selected from the group consisting of glucose, galactose, saccharose, sucralose, and stereoisomers thereof. ~~further comprising~~

~~(H) a sugar compound selected from the group consisting of glucose, galactose, saccharose, sucralose, and stereoisomers thereof.~~

~~11.~~10. The CMP composition according to anyone of the claims 1 to ~~7~~8, wherein the pH value of the composition is in the range of from 5 to 9.

~~12.~~11. The CMP composition according to claim 1, wherein

(A) are ceria particles,

(B) is hydrophobin.

~~13.~~12. A process for the manufacture of semiconductor devices comprising the chemical mechanical polishing of a substrate in the presence of a CMP composition as defined in anyone of the claims 1 to ~~11~~12.

~~14.~~13. Use of a CMP composition as defined in anyone of the claims 1 to ~~11~~12 for chemical mechanical polishing of a substrate used in the semiconductor industry.

~~15.~~14. Use according to claim ~~13~~14, wherein the substrate comprises

(i) silicon dioxide, and

(ii) silicon nitride, or polysilicon.