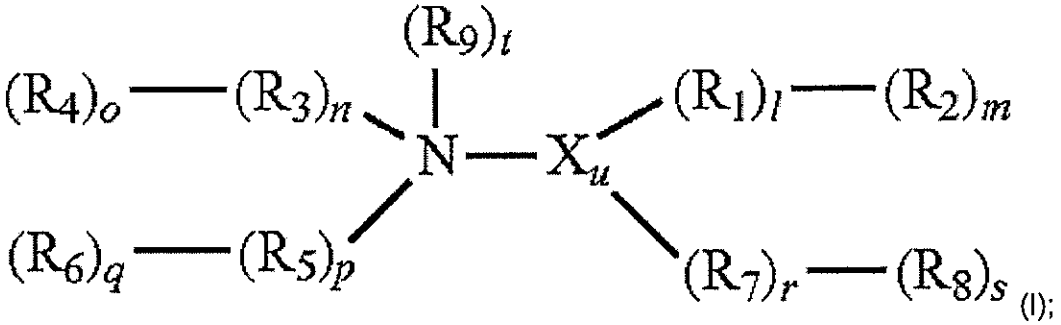
Claims

1. A chemical mechanical polishing (CMP) composition (Q), comprising:

(A) cocoon-shaped silica particles;
(B) a compound or salt of general formula (I) having at least one polymeric polyether chain:



(I);

wherein:

X is CH_2N, CH_2CH_2N, $CH_2CH_2CH_2N$, $CH_2CH_2CH_2CH_2N$, CH, CH_2, CH_2CH, CH_2CH_2CH, C=O or CH_2CH_2O, wherein X is bonded by the carbon atom of the respective group to the nitrogen;

R_1, R_2, R_3, R_4, R_5, R_6, R_7, R_8 and R_9 are each independently O^-, H, OH, COO^-, COONa, CH, CH_2, CH_3, CH_2CH_3, C_1-C_{20}-alkyl, C_2-C_{20}-alkenyl with at least one carbon carbon double bond, C_1-C_{20}-alkyl-acyl, C_2-C_{20}-alkenyl-acyl, CH_2CH_2OH, OHCHCHOH, CH_2COO^-, CH_2COONa, CH_2CH_2O, or $CH_2CH(CH_3)O$;

u is 1;
t is 0 or 1;
l, m, o, q and s are each independently an integer within a range of from 0 to 500; and
n, p, r are each independently an integer within a range of from 1 to 500;

with the proviso that when X is CH_2, C=O, or CH_2CH_2O, then l and m are zero, and when X is CH_2N, CH_2CH_2N, $CH_2CH_2CH_2N$, $CH_2CH_2CH_2CH_2N$, CH, CH_2CH, CH_2CH_2CH, then l is at least one; and

(C) an aqueous medium,
wherein the composition (Q) has a pH of from 2 to 6.

2. The CMP composition (Q) according to claim 1, wherein, in formula (I):
X is CH_2N, CH_2CH_2N, $CH_2CH_2CH_2N$, or $CH_2CH_2CH_2CH_2N$, and bonded to the nitrogen by a carbon atom of the terminal CH_2;
R_1, R_2, R_3, R_4, R_5, R_6, R_7 and R_8 are each independently CH_2CH_2O or $CH_2CH(CH_3)O$ forming a polyether; and t is 0,
wherein a last oxyalkylene group of the polyether chain has a hydroxy function.

3. The CMP composition (Q) according to claim 2, wherein, in formula (I):
the number of CH_2CH_2O groups in the polyether ranges from 1 to 300; and
the number of $CH_2CH(CH_3)O$ groups ranges from 1 to 500.

4. The CMP composition (Q) according to claim 1, wherein, in formula (I):
X is CH_2CH_2N, and bonded to the nitrogen by the carbon atom of the terminal CH_2;
R_1, R_3, R_5 and R_7 are $CH_2CH(CH_3)O$;
m, l, n, o, p, q, r, and s are 1;
t is 0; and
R_2, R_4, R_6 and R_8 are hydrogen.

5. The CMP composition (Q) according to claim 1, wherein, in formula (I):
X is CH_2CH_2O, and bonded to the nitrogen by the carbon atom of the terminal CH_2 of the CH_2CH_2O;
R_3, R_4, R_5, R_6, R_7 and R_8 are each independently CH_2CH_2O or $CH_2CH(CH_3)O$ forming a polyether; and t is 0, and
wherein a last oxyalkylene group of the polyether chain has a hydroxy function.

6. The CMP composition (Q) according to claim 5, wherein the number of CH_2CH_2O groups in the polyether ranges from 1 to 50 and the number of $CH_2CH(CH_3)O$ groups is in the range of from 1 to 100.

7. The CMP composition (Q) according to claim 1, wherein, in formula (I):
X is C=O, and bonded to the nitrogen by the carbon atom of the carbonyl group forming an amide;
R_3 is H, CH_2CH_2O, or $CH_2CH(CH_3)O$, with the proviso that when R_3 is H, then n is 1 and o is 0, and when R_3 is CH_2CH_2O or $CH_2CH(CH_3)O$, then R_4 is H and o is 1;
R_5 is CH_2CH_2O or $CH_2CH(CH_3)O$;
R_6 is H;
R_7 and R_8 are independently from each other C_1-C_{20}-alkyl or C_2-C_{20}-alkenyl with at least one carbon carbon double bond; and
t is 0.

8. The CMP composition (Q) according to claim 1, where in formula (I):
X is CH_2, CH_2N, CH_2CH_2N, or $CH_2CH_2CH_2N$, and bonded to the nitrogen by a carbon atom of the terminal CH_2, with the proviso that when X is CH_2, then l is 0 and m is 0, and when X is CH_2N, CH_2CH_2N, or $CH_2CH_2CH_2N$, then l is 1, m is 0, and R_1 is H;
R_3 is CH_2, CH_3 or CH_2CH_2O, with the proviso that when R_3 is CH_3, then n is 1 and o is 0, and when R_3 is CH_2 or CH_2CH_2O, then n is an integer from 1 to 4 and o is 1, and R_4 is OH or CH_2COONa;
R_5 is CH_2COO^- OR H_2COONa
p is 1;
q is 0;
R_7 is C_8-C_{16}-alkyl or C_1-C_{16}-acyl;
r is 1;
s is 0,
R_9 is O^-, CH_3 or CH_2CH_3; and
t is 1.

9. The CMP composition (Q) according to claim 1, wherein in formula (I):
X is CH_2CH or CH_2CH_2CH, and bonded to the nitrogen by the carbon atom of the terminal CH_2, or X is C=O, and bonded to the nitrogen by the carbon atom of the carbonyl group, with the proviso that when X is C=O, then l is 0, m is 0, r is 1, s is 0, and R_7 is a C_8-C_{16}-alkyl or C_8-C_{16}-alkenyl with at least one carbon carbon double bond, and when X is CH_2CH or CH_2CH_2CH, then l is 1, m is 0, r is 1, s is 0, and R_7 is OH;
R_1 is C_8-C_{16}-alkyl or C_8-C_{16}-alkenyl with at least one carbon carbon double bond;
R_3 is CH_2;
n is an integer from 1 to 4;
R_4 is –OH;
o is 1;
R_5 is CH_2 or CH_3, with the proviso that when R_5 is CH_3, then p is 1 and q is 0, and when R_5 is CH_2, then p is an integer from 1 to 4, R_6 is OH, and q is 1;
R_9 is CH_3 or CH_2CH_3; and
t is 1.

10. The CMP composition (Q) according to claim 1, wherein in formula (I):
X is CH;
R_1 is CH_2;
l is an integer from 1 to 4;
R_2 is OH;
m is 1;
R_3 is H or CH_2CH_2O, with the proviso that when R_3 is H, then n is 1 and o is 0, and when R_3 is CH_2CH_2O, then n is an integer from 1 to 4 and o is 1, and R_4 is C_8-C_{16}-alkyl, C_8-C_{16}-acyl, or C_8-C_{16}-alkenyl with at least one carbon carbon double bond;

R_5 is H or CH_2CH_2O, with the proviso that when R_5 is H, then p is 1 and q is 0, and when R_5 is CH_2CH_2O, then p is an integer from 1 to 4, q is 1, and R_6 is C_8-C_{16}-alkyl, C_8-C_{16}-acyl, C_8-C_{16}-alkenyl with at least one carbon carbon double bond;
R_7 is H, CHOH, HOCHCHOH, r is 1 and R_8 is C_4-C_{16}-alkyl, s is 1
R_9 is CH_3;
t is 1; and
the anion is Cl^-, Br^-, I^- or $[CH_3OSO_2]^-$.

11. The CMP composition (Q) according to claim 1, wherein the CMP composition (Q) further comprises (D) an oxidizing agent.

12. A method, comprising:
chemical mechanical polishing of a substrate (S) used in the semiconductor industry with the CMP composition (Q) of claim 1.

13. The method according to claim 12, wherein the substrate (S) comprises:
(i) elemental germanium; or
(ii) $Si_{1-x}Ge_x$ with $0.1 \leq x < 1$.

14. The method of claim 13, wherein the elemental germanium is grown in trenches between the STI (shallow-trench isolation) silicon dioxide.

15. A process for the manufacture of a semiconductor device, the process comprising chemical mechanical polishing of substrate (S) used in the semiconductor industry in the presence of the CMP composition (Q) of claim 1.

16. The process according to claim 15, wherein the substrate (S) comprises:
(i) elemental germanium; or
(ii) $Si_{1-x}Ge_x$ with $0.1 \leq x < 1$.