R^1 and R^2 are both independently selected from the group consisting of bromine and chlorine

as corrosion inhibitor, especially for increasing the selectivity of a chemical mechanical polishing (CMP) composition for the removal of tantalum or tantalum nitride from a substrate for the manufacture of a semiconductor device in the presence of copper on said substrate.

In another aspect, there is provided the use of a compound selected from the group consisting of

5-bromo-1H-benzotriazole,
5-tert-butyl-1H-benzotriazole,
5-(benzoyl)-1H-benzotriazole,
5,6-dibromo-1H-benzotriazole,
5-chloro-1H-benzotriazole,
5-sec-butyl-1H-benzotriazole,
4,5,6,7-tetrahydro-1H-benzotriazole,

for increasing the selectivity of a chemical mechanical polishing (CMP) composition for the removal of tantalum or tantalum nitride from a substrate for the manufacture of a semiconductor device in the presence of copper on said substrate.

Constituent (A): corrosion inhibitor

The compound of formula (1) as defined above acts as a corrosion inhibitor. It is presently believed that the compound of formula (1) can act as corrosion inhibitor by forming a protective molecular layer on the surface of a metal, e.g. copper. Surprisingly it has now been found that the compounds of formula (1) in contrast to the compound benzotriazole (BTA) and in contrast to other derivatives of BTA used in the prior art CMP compositions have an advantageous effect on the selectivity of the removal of tantalum or tantalum nitride versus the removal of copper, when the compound of formula (1) is a constituent of a chemical-mechanical polishing (CMP) composition used for polishing of a substrate comprising both tantalum or tantalum nitride and copper. Furthermore, a compound of formula (1) used as a constituent of a chemical-mechanical polishing (CMP) composition positively influences the removal rate of tantalum or tantalum nitride. Thus, in a typical chemical-mechanical polishing (CMP) composition comprising a compound of formula (1) as an active constituent a high removal rate for tantalum or tantalum nitride is accomplished, and at the same time a high selectivity of the removal of tantalum or tantalum nitride versus the removal of copper.

Generally, constituent (A), i.e. the total amount of compound(s) of formula (1) can be contained in any of a broad range of proportions in the CMP composition of

(C) a total amount of one or more complexing agents selected from the group of organic acids and salts thereof in a range of from 0.001 to 10 wt.-% based on the total weight of the respective CMP composition,

and/or

(D) a total amount of one or more non-ionic surfactants in a range of from 0.00001 to 10 wt.-% based on the total weight of the respective CMP composition,

and/or

(E) a total amount of one or more alcohols in a range of from 0.001 to 10 wt.-% based on the total weight of the respective CMP composition,

and/or

(F) a total amount of one or more oxidizing agents in a range of from 0.01 to 20 wt.-% based on the total weight of the respective CMP composition,

and/or

(I) a total amount of one or more buffers in a range of from 0.001 to 10 wt.-% based on the total weight of the respective CMP composition.

10. Chemical mechanical polishing (CMP) composition according to any preceding claim, wherein the CMP composition contains cations selected from the group consisting of magnesium and calcium in a total amount of less than 0.9 ppm based on the total weight of the respective CMP composition, preferably in an amount of less than 0.5 ppm based on the total weight of the respective CMP composition, and most preferably does not contain any cations selected from the group consisting of magnesium and calcium.

11. A process for the manufacture of a semiconductor device comprising chemical mechanical polishing of a substrate in the presence of a chemical mechanical polishing (CMP) composition as defined in any of claims 1 to 10.

12. The process according to claim 11, wherein the substrate comprises a surface region consisting of tantalum or tantalum nitride or of a tantalum alloy and/or a surface region consisting of copper or of a copper alloy.

13. Use of a compound selected from the group consisting of

5-bromo-1H-benzotriazole,

5-tert-butyl-1H-benzotriazole,

5-(benzoyl)-1H-benzotriazole,

5,6-dibromo-1H-benzotriazole,

5-chloro-1H-benzotriazole,

5-sec-butyl-1H-benzotriazole,

4,5,6,7-tetrahydro-1H-benzotriazole,

for increasing the selectivity of a chemical mechanical polishing (CMP) composition for the removal of tantalum or tantalum nitride from a substrate for the manufacture of a semi-conductor device in the presence of copper on said substrate.