

Claims

1. Particulates comprising:

solid metal compound coated colloidal particles formed by bonding metal compound particles on surfaces of colloidal particles and optionally solvent; wherein

5 spaces among solid metal compound coated colloidal particles are free of the metal compound particles;

and wherein

the size of the metal compound particles is in the range of ~~0.01-101-10~~ nm;

the size of the colloidal particles is in the range of 10-1000 nm; and

10 the size of the metal compound particles is smaller than the size of colloidal particles.

2. The particulates of Claim 1, wherein the colloidal particles are particles

selected from silica particles, lattice doped silica particles, germania particles, alumina particles, lattice doped alumina particles, titania particles, zirconium oxide particles,

15 ceria particles, organic polymeric particles, and combinations thereof; and/or the metal compounds are compounds selected from selected from Fe compounds, Cu compounds, Ag compounds, Cr compounds, Mn compounds, Co compounds, Ni compounds, Ga compounds, and combinations thereof.

20 3. The particulates of Claim 1, wherein the colloidal particles are silica particles; the metal compounds are iron compounds; and the metal compound coated colloidal particles are iron compound coated silica particles.

4. A method of making solid metal compound coated colloidal particles ~~optionally being~~
25 ~~particulates~~ as claimed in any one of the preceding claims comprising:

providing a solution comprising colloidal particles;

providing a soluble metal compound precursor;

providing a base;

adding the soluble metal compound precursor, and the base
~~independently~~independently to the solution comprising colloidal particles;
and

forming the solid metal compound coated colloidal particles;

wherein the soluble metal compound precursor reacts with the base solution to
form

solid metal compounds which are coated onto colloidal particle surfaces
through bonding.

5. The method of making solid metal compound coated colloidal particles of Claim 4,
wherein the soluble metal compound precursor is selected from a nitrate salt, a sulfate
salt, a chloride salt, an oxide and combinations thereof and/or the base is selected from
the group consisting of KOH, NH₄OH, NaOH, KHCO₃, K₂CO₃, quaternary ammonium
hydroxides, organic amines, phosphonium hydroxides, N-heterocyclic compounds, and
combinations thereof.

6. The method of making solid metal compound coated colloidal particles of Claim
4, wherein the colloidal particles are silica particles; the metal compounds are iron
compounds; the base is KOH or NH₄OH; and the metal compounds coated colloidal
particles are iron compound coated silica particles.

7. The method of making solid metal compound coated colloidal particles of any
one of Claims 4 to 6, wherein the weight % ratio of the metal compound precursor to the
colloidal particles is in the range of 0.001 to 3; and/or the molar ratio of the base to the
metal compound precursor is higher than 2.5.

8. The method of making solid metal compound coated colloidal particles of any
one of Claims 4 to 7, further comprising a step of removing excess ions
comprising metal ions from the solution containing the solid metal compound
coated colloidal particles, optionally through an ultrafiltration process.

9. The method of making solid metal compound coated colloidal particles of any one
of Claims 4 to 8, wherein the method further comprises a step of heating the solution

containing the solid metal compound coated colloidal, preferably at a temperature in the range of 40°C to 100 °C for 0.5 to 72 hours.

5 10. The method of making solid metal compound coated colloidal particles of Claim 8 or Claim 9, wherein the remaining concentration of excess metal ions in the solution is less than 2 ppm, and/or the concentration of the solution containing the solid metal compound coated colloidal particles is in the range of 0.01 to 50 wt%.

10 11. A composition for chemical-mechanical polishing comprising:
solid metal compound coated colloidal particles ~~optionally being particulates as~~
claimed in any one of Claims 1 to 3; and
an oxidizer;

15 wherein the solid metal compound coated colloidal particles comprise metal compounds having size in the range of 0.01 to 10 nm coated on surfaces of colloidal particles having size in the range of 10 to 1000 nm; the size of the metal compounds
is smaller than the size of colloidal particles; and the metal compounds are solely coated on the surfaces of colloidal particles through bonding.

20 12. The composition of Claim 11, wherein the composition is an aqueous composition and the solid metal compound coated colloidal particles are dispersed uniformly in an aqueous solvent.

25 13. The composition of Claim 11 or Claim 12, further comprising an abrasive, and optionally a corrosion inhibitor.

14. A method of chemical mechanical polishing, comprising the steps of:

- 30 a) providing a semiconductor substrate;
b) providing a polishing pad;
c) providing a composition as claimed in any one of Claims 11 to 13;
d) contacting the surface of the semiconductor substrate with the polishing pad and the composition; and
e) polishing the surface of the semiconductor substrate;