

[0034] One of these organic silicon compounds may be used alone, or two or more thereof may be mixed. The concentration of the organic silicon compound (if two or more compounds are contained, their total concentration) is not limited to any particular value; for example, where the amount of silica is represented as 100 parts by weight, the concentration may be 1 to 300 parts by weight. The lower limit for the concentration of the organic silicon compound is preferably 2 parts by weight, more preferably 5 parts by weight, and yet more preferably 10 parts by weight, where the amount of silica is represented as 100 parts by weight. The upper limit for the concentration of the organic silicon compound is preferably 100 parts by weight, more preferably 50 parts by weight, and more preferably 30 parts by weight, where the amount of silica is represented as 100 parts by weight.

[0035] In the polishing composition according to the present embodiment, the molecular weight of the organic silicon compound, M, the concentration of the organic silicon compound, c_c, the primary particle size of the silica, d_1, the true density of the silica, ρ_0, and the concentration of the silica, c_s, preferably satisfy the following expression:

$$(78260/M\times c_c)/\{6/(d_1\times\rho_0)\times 1000\times c_s\}\times 100\geq 8.0,$$

where the unit for d_1 is nm, the unit for ρ_0 is g/cm^3, and the unit for c_c and c_s is weight %.

[0036] In the above expression, "$6/(d_1\times\rho_0)\times 1000$" represents the specific surface area (m^2/g), where it is assumed that the silica is a sphere with a diameter of d_1. "78260/M" represents the minimum area of coating of the organic silicon compound determined from the Stuart–Briegleb molecular model (m^2/8). The left side of the above expression "$(78260/M\times c_c)/\{6/(d_1\times\rho_0)\times 1000\times c_s\}\times 100\geq 8.0$" means the ratio (%) of the total minimum area of coating of the organic silicon compound in the polishing composition relative to the total surface area of the silica in the polishing composition (%). This value will be hereinafter referred to as "percentage of coating". The percentage of coating is more preferably not less than 10 %, and yet more preferably not less than 20 %. The primary particle size d_1 of the silica means the average particle size obtained by the BET method.

CLAIMS

1. A polishing composition, comprising:

silica with a silanol group density of 2.0 OH/nm^2 or higher; and

an organic silicon compound having, at a terminal, an amino group, methylamino group, dimethylamino group or quaternary ammonium group,

the organic silicon compound having two or more alkoxyl groups or hydroxyl groups bonded to an Si atom thereof,

wherein the quaternary ammonium group of the organic silicon compound does not have an alkyl group with a carbon number of two or more.

2. The polishing composition according to claim 1, wherein the organic silicon compound includes three or more alkoxyl groups or hydroxyl groups bonded to the Si atom.

3. The polishing composition according to claim 1 or 2, wherein the organic silicon compound is expressed by the following general formula, (1):

$X^1–(R^1–NH)_n–X^2–Si(OR^2)_m(R^3)_{3-m}$ (1),

where X^1 indicates an amino group, methylamino group, dimethylamino group, or quaternary ammonium group; X^2 indicates a single bond or a divalent hydrocarbon group with a carbon number of 1 to 8; R^1 indicates a divalent hydrocarbon group with a carbon number of 1 to 8; R^2 indicates a hydrogen atom or a monovalent hydrocarbon group with a carbon number of 1 to 6; R^3 indicates a monovalent hydrocarbon group with a carbon number of 1 to 10; n indicates an integer of 0 to 2; and m indicates 2 or 3, where the quaternary ammonium group of X^1 does not have an alkyl group with a carbon number of 2 or more.

4. The polishing composition according to claim 1 or 2, wherein the organic silicon compound is expressed by the following general formula, (2):

$X^3–(R^4–NH)_k–X^5–Si(OR^6)_h(R^8)_{2-h}–O–Si(OR^7)_i(R^9)_{2-i}–X^6–(NH–R^5)_j–X^4$ (2),

where each of X^3 and X^4 independently indicates an amino group, methylamino group, dimethylamino group, or quaternary ammonium group; each of X^5 and X^6 independently indicates a single bond or a divalent

hydrocarbon group with a carbon number of 1 to 8; each of R^4 and R^5 independently indicates a divalent hydrocarbon group with a carbon number of 1 to 8; each of R^6 and R^7 independently indicates a hydrogen atom or a monovalent hydrocarbon group with a carbon number of 1 to 6; each of R^8 and R^9 independently indicates a monvalent hydrocarbon group with a carbon number of 1 to 10; each of k and j independently indicates an integer of 0 to 2; and each of h and i independently indicates 1 or 2, wherein the quaternary ammonium group of X^3 and X^4 does not have an alkyl group with a carbon number of 2 or more.

5. The polishing composition according to any one of claims 1 to 4, wherein the concentration of the organic silicon compound is 2 or more parts by weight, where the amount of silica is represented as 100 parts by weight.

6. The polishing composition according to any one of claims 1 to 5, wherein the molecular weight of the organic silicon compound, M, the concentration of the organic silicon compound, c_c, the primary particle size of the silica, d_1, the true density of the silica, ρ_0, and the concentration of the silica, c_s, satisfy the following expression:

$(78260/M\times c_c)/\{6/(d_1\times\rho_0)\times 1000\times c_s\}\times 100\geq 8.0$,

where the unit for d_1 is nm, the unit for ρ_0 is g/cm^3, and the unit for c_c and c_s is weight %.

7. The polishing composition according to any one of claims 1 to 6, further comprising a basic compound other than the organic silicon compound.

8. The polishing composition according to claim 7, wherein the basic compound is an inorganic compound.

9. The polishing composition according to claim 7, wherein the basic compound is an amine compound.

10. The polishing composition according to any one of claims 1 to 9, further comprising a water-soluble polymer.