

CLAIMS

1. Cerium based particles having substantially the shape of polyhedrons which have one or more faces with protrusions thereon, said protrusions being integrally formed with said cerium based particles.
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2. Cerium based particles according to claim 1, wherein the protrusions extend over at least 60%, in particular at least 70%, in particular at least 80%, in particular at least 90 %, of the surface of said face.
- 10 3. Cerium based particles according to claim 1 or 2, wherein the protrusions are blunt.
4. Cerium based particles according to any of claims 1 to 3, having at least one edge portion and/or corner being substantially free from protrusions.
- 15 5. Cerium based particles according to any of claims 1 to 4, wherein said polyhedrons are cubes, truncated octahedrons or combinations thereof.
- 20 6. Cerium based particles according to any of claims 1 to 5, wherein said particles are made of cerium oxide or of a mixed oxide of cerium and at least one metal (M), preferably chosen among lanthanum, praseodymium and neodymium, being more preferably lanthanum.
- 25 7. Cerium based particles according to claim 6, wherein the particles made of a mixed oxide of cerium and at least one metal (M) have a molar ratio $M/(M+Ce)$ comprised between 0.01 and 0.15, more particularly between 0.01 and 0.12, even more particularly between 0.01 and 0.04, especially between 0.02 and 0.03.
- 30 8. Cerium based particles according to any of claims 1 to 7, characterized by a specific surface area (BET) comprised between 16 and 55 m²/g, more particularly between 17 and 50 m²/g, even more particularly between 18 and 45 m²/g, especially between 19 and 42 m²/g.

- 5 9. Cerium based particles according to any of claims 1 to 8, characterized by an hydrodynamic mean diameter D_h determined by dynamic light scattering comprised between 75 nm and 1000 nm, more particularly between 80 nm and 500 nm, even more particularly between 85 nm and 300 nm, especially between 90 nm and 240 nm.
- 10 10. Cerium based particle according to any of claims 1 to 9, characterized by a median diameter D_{50} determined by laser diffraction comprised between 70 nm and 200 nm, more particularly between 75 nm and 170 nm, even more particularly between 79 nm and 150 nm.
- 15 11. Cerium based particle according to any of claims 1 to 10, characterized by a diameter D_{10} determined by laser diffraction comprised between 55 nm and 200 nm, more particularly between 60 nm and 150 nm, even more particularly between 65 nm and 110 nm.
- 20 12. Cerium based particle according to any of claims 1 to 11, characterized by a diameter D_{90} determined by laser diffraction comprised between 80 nm and 300 nm, more particularly between 90 nm and 260 nm, even more particularly between 94 nm and 230 nm.
- 25 13. Cerium based particle according to any of claims 1 to 12, characterized by a diameter D_{99} determined by laser diffraction comprised between 90 nm and 400 nm, more particularly between 100 nm and 385 nm, even more particularly between 107 nm and 370 nm.
- 30 14. Cerium based particle according to any of claims 1 to 13, characterized by a dispersion index σ/m lower than 0.60, particularly lower than 0.42, wherein $\sigma/m = (D_{90}-D_{10})/2D_{50}$, D_{10} , D_{50} and D_{90} being determined by laser diffraction.
15. Cerium based particle according to any of claims 1 to 14, characterized by a ratio D_{90}/D_{50} comprised between 1.10 and 1.60, D_{50} and D_{90} being determined by laser diffraction.

16. Dispersion of cerium based particles according to any one of claims 1 to 15 in a liquid medium.
17. Dispersion according to claim 16 exhibiting a conductivity lower than 300 $\mu\text{S}/\text{cm}$,
5 more particularly lower than 150 $\mu\text{S}/\text{cm}$, even more particularly lower than 100 $\mu\text{S}/\text{cm}$, especially lower than 50 $\mu\text{S}/\text{cm}$.
18. Use of the cerium based particles according to any of claims 1 to 15 or the dispersion according to claim 16 or 17 for the preparation of a polishing
10 composition, more particularly a chemical mechanical polishing composition.
19. Polishing composition comprising the cerium based particles according to any of claims 1 to 15 or the dispersion according to claim 16 or 17.
- 15 20. Polishing composition according to claim 19, further comprising one or more of the following ingredients: abrasive particles other than the cerium based particles according to any of claims 1 to 15; and/or a pH regulator; and/or a surfactant; and/or a rheological control agent, including viscosity enhancing agents and coagulants; and/or an additive selected from an additive selected from an anionic
20 copolymer of a carboxylic acid monomer, a sulfonated monomer, or a phosphonated monomer, and an acrylate, a polyvinylpyrrolidone, or a polyvinylalcohol (e.g., a copolymer of 2-hydroxyethylmethacrylic acid and methacrylic acid); a nonionic polymer, wherein the nonionic polymer is polyvinylpyrrolidone or polyethylene glycol; a silane, wherein the silane is an
25 amino silane, an ureido silane, or a glycidyl silane; an N-oxide of a functionalized pyridine (e.g., picolinic acid N-oxide); a starch; a cyclodextrin (e.g., alpha-cyclodextrin or beta-cyclodextrin), and combinations thereof.
21. Method of removing a portion of a substrate, the method comprising polishing the
30 substrate with a polishing composition according to claim 19 or 20.
22. Semiconductor comprising a substrate polished by the method according to claim 21.

23. Process for producing the cerium based particles according to any of claims 1 to 15, comprising the following steps:

- 5 (a) contacting, under an inert atmosphere, an aqueous solution of a base and an aqueous solution comprising NO_3^- , Ce^{III} , optionally Ce^{IV} , optionally $\text{M}^{\text{n}+}$ with M a metal of valence n, wherein the difference between the base/total(Ce+optional M) molar ratio and the $\text{NO}_3^-/\text{Ce}^{\text{III}}$ molar ratio is lower than 2;
- 10 (b) subjecting the mixture obtained in step (a) to a thermal treatment, wherein the temperature is comprised between 55 and 75°C;
- (c) optionally acidifying the mixture obtained in step (b);
- (d) optionally washing with water the solid material obtained at the end of step (b) or (c);
- 15 (e) optionally subjecting the solid material obtained at the end of step (d) to a mechanical treatment to deagglomerate the particles.