CLAIMS

1. A composited coating solution containing silica alumina sol doped by nano core-shell silica micro-sphere, characterized in that the coating solution is composited by a sol of a nano core-shell silica micro-sphere with a hydroxyl-containing silica alumina sol material, wherein, the nano core-shell silica micro-sphere is obtained by a preparation method comprising the following steps:

(1) preparation of polystyrene core by emulsifier-free emulsion polymerization: putting an amino-containing or quaternized co-monomer and water in a reaction vessel, adding styrene, then heating the mixture up to 50-85℃ under the protection of nitrogen gas, and dropwise adding an initiator aqueous solution to react, and whereby obtaining a cationic polystyrene emulsion;

(2) preparation of a silica coated polystyrene core-shell structured micro-sphere emulsion: mixing the cationic polystyrene emulsion used as a hard template with a solvent, then adding a silicon source material under conditions of stirring at 15-35℃ to react and obtaining the silica coated polystyrene nano core-shell structured micro-sphere emulsion.

2. The composited coating solution according to claim 1, wherein, calculated by weight percentage, the volume ratio of the hydroxyl-containing silica alumina sol to nano core-shell silica micro-sphere sol is 1：(1-10), preferably 1：(4-10).

3. The composited coating solution according to claim 1 or 2, wherein, the hydroxyl-containing silica alumina sol material is obtained by reaction of materials containing water, acid catalyst, solvent, aluminum salt and silicon source material, wherein, relative to 1 mL of silicon source material, the mass of aluminum salt is 0.025-0.1g, preferably 0.055-0.1g.

4. The composited coating solution according to claim 3, wherein, relative to 1 mL of silicon source material, the content of solvent is 1-20mL, the content of water is 0.1-1mL, and the content of catalyst is 0.01-0.1mL.

5. The composited coating solution according to claim 3 or 4, wherein said catalyst is selected from one or more of the group consisting of hydrochloric acid, nitric acid, sulfuric acid, phosphoric acid, acetic acid, citric acid and oxalic acid.

6. The composited coating solution according to any one of claims 1 to 5, wherein said silicon source material added in the preparation of hydroxyl-containing silica alumina sol is selected from one or more of tetramethoxysilane, tetraethoxysilane, methyl trimethoxy silane, methyl triethoxysilane, vinyl trimethoxy silane, vinyl triethoxy silane, γ-mercaptopropyl trimethoxy silane, γ-aminopropyl triethoxy silane, γ-glycidoxy propyl trimethoxy silane or γ-(methacryloyloxy) propyl trimethoxy silane.

7. The composited coating solution according to any one of claims 1-6, wherein, in step (1), said co-monomer is an amino-containing vinyl monomer and / or a quaternized vinyl monomer; preferably, said quaternized vinyl monomer is selected from one or more of the group consisting of acryloyloxyethyl trimethoxy ammonium chloride, methacryloyloxyethyl trimethyl ammonium chloride, (meta)acrylamino propyl trimethyl ammonium chloride, or diallyl dimethyl ammonium chloride; said amino-containing vinyl monomer is selected from one or more of the group consisting of dimethylamino ethyl (meta)acrylate, diethylamino ethyl (meta)acrylate or diisopropylamino ethyl (meta)acrylate.

8. The composited coating solution according to any one of claims 1-7, wherein, in step(2), said silicon source material is selected from one or more of the group consisting of tetramethoxysilane, tetraethoxysilane, methyl trimethoxy silane, methyl triethoxysilane, vinyl trimethoxy silane, vinyl triethoxy silane, γ-mercaptopropyl trimethoxy silane, γ-aminopropyl triethoxy silane, γ-glycidoxy propyl trimethoxy silane or γ-(methacryloxy) propyl trimethoxy silane .

9. The composited coating solution according to any one of claims 1-8, wherein, in step(1), said initiator is potassium persulfate or

2,2’-azobis(2-methylpropionamidine) hydrochloride.

10. The composited coating solution according to any one of claims 1-9, wherein, in step (1) , a mass ratio of the co-monomer to the styrene monomer is (0.5-4）：（10-20）.

11. The composited coating solution according to any one of claims 1-10, wherein, in step (1), a mass ratio of the co-monomer, the styrene monomer, the initiator and the water in the total system is 0.5-4% of the co-monomer, 10-20% of the styrene monomer, 0.1-1% of the initiator and 75-89.4% of the water, respectively.

12. The composited coating solution according to any one of claims 1-11, wherein, in step (2), the amount of solvent is based on the standard of diluting the cationic polystyrene emulsion to a solid content of 1-20 mass%.

13. The composited coating solution according to any one of claims 1-12, wherein, in step (2), a mass ratio of solid content in the polystyrene emulsion to the added silicon source material is 10-30%.

14. The composited coating solution according to any one of claims 1-13, wherein, in step (2), the solvent is selected from one or more of the group consisting of water, methanol, ethanol, ethylene glycol, n-propyl alcohol, isopropyl alcohol, propylene glycol, glycerol, n-butyl alcohol, ethylene glycol monomethyl ether, ethylene glycol monoethyl ether, propylene glycol methyl ether, propylene glycol butyl ether, tripropylene glycol monomethyl ether or tripropylene glycol monoether.

15. The composited coating solution according to any one of claims 1-14, wherein, when the co-monomer is an amino-containing vinyl monomer, an acid is needed for protonation treatment to the amino-containing vinyl monomer before step (1), and the acid used is selected from an inorganic acid or an organic acid.

16. The composited coating solution according to claim 15, wherein, said the inorganic acid is hydrochloric acid, sulfuric acid, nitric acid or phosphoric acid,

and the organic acid is acetic acid, citric acid or oxalic acid; preferably, the required amount of inorganic acid based on calculation by monoacid is that the molar ratio of acid to the amino group contained in the amino-containing vinyl monomers is 50-100%.

17. The composited coating solution according to any one of claims 1-16, wherein, in step (1), after adding styrene, stirring the obtained mixture at 150-500rpm, preferably 200-450rpm.

18. The composited coating solution according to any one of claims 1-17, wherein, in step (1), dropwise adding the initiator at the speed of 0.1-2mL/min, preferably 0.5-1.5mL/min.

19. A preparation method of the composited coating solution containing silica alumina sol doped by nano core-shell silica micro-sphere according to any one of claims 1 to 18, wherein, the composited coating solution containing silica alumina sol doped by nano core-shell silica micro-sphere is obtained by compositing a sol of the nano core-shell silica micro-sphere with a hydroxyl-containing silica alumina sol material.

20. An application of the composited coating solution containing silica alumina sol doped by nano core-shell silica micro-sphere sol of any one of claims 1 to 18 for the preparation of increased permeability and anti-reflection film in a surface of photovoltaic glass, optical device or solar device.