Claims

1. A superwetting surface, which is a polypropylene surface having a micro-nano structure and grafted with a hydrophilic side group, wherein the superwetting surface is at least super-hydrophilic and has a water contact angle of less than or equal to 10°; and the superwetting surface does not contain an initiator residue.

2. The superwetting surface according to claim 1, characterized in that the water contact angle of the superwetting surface is less than or equal to 8°, more preferably less than or equal to 5°, even more preferably less than or equal to 1°, and most preferably about 0°.

3. The superwetting surface according to claim 1 or 2, characterized in that the feature size of the micro-nano structure of the polypropylene surface as the grafting base is 1 nm-100 μm; preferably the micro-nano structure is a structure produced on the polypropylene surface by a thermally-induced phase separation process, photolithography technology, femtosecond laser processing technology, plasma etching technology, electrospinning method, nano-imprinting, nano-casting, ultra-precision micro-milling technology or by an electric arc.

4. The superwetting surface according to claim 3, characterized in that the polypropylene surface as the grafting base is a polypropylene porous membrane, a polypropylene flat membrane or a polypropylene hollow fiber microporous membrane, wherein the polypropylene porous membrane preferably has an average pore diameter of less than 100 μm, preferably 10 nm-80 μm, and preferably has a porosity of 50-90%, more preferably 60-80%.

5. The superwetting surface according to any one of claims 1 to 4, characterized in that the hydrophilic side group comprises a unit formed from one or more monomers containing a heteroatom selected from the group consisting of oxygen, sulfur, nitrogen, silicon, halogen and combinations thereof or a substituent thereof and containing a carbon-carbon double bond; preferably, the monomer is at least one selected from the group consisting of organic acids and derivatives thereof (for example, anhydrides, esters, and salts) and vinyl silanes; wherein the organic acid and derivative thereof is preferably selected from the group consisting of maleic anhydride and derivatives thereof, (meth)acrylic acid and derivatives thereof (e.g., glycidyl methacrylate), vinyl

acetate, alkenyl sulfonic acid and derivatives thereof, vinyl benzoic acid and derivatives thereof, itaconic acid and derivatives thereof, oleic acid and derivatives thereof, arachidonic acid and derivatives thereof (in particular their salt forms) and combinations thereof; wherein the vinyl silane is preferably one or more of the compounds represented by Formula (1):

$$CH_2=CH-(CH_2)_nSiX_3 \qquad \text{Formula (1)},$$

wherein n=0 to 3, each X is the same or different and independently represents a chloro group, a methoxy group, an ethoxy group, and an acetoxy group;more preferably, the hydrophilic side group comprises or consists of a unit formed from a salt of an organic acid.

6. The superwetting surface according to any one of claims 1 to 5, characterized in that the polypropylene surface is further grafted with a lipophilic side group; the lipophilic side group is preferably selected from the group consisting of vinyl silicone oil side groups, styrene side groups and combinations thereof; the vinyl silicone oil is preferably selected from the group consisting of vinyl-terminated silicone oils, high-vinyl silicone oils and combinations thereof, and more preferably is selected from the group consisting of methyl vinyl silicone oil, vinyl hydrogen-containing silicone oil, divinyl silicone oil and combinations thereof; preferably, the oil contact angle of the superwetting surface is less than 90°, preferably less than or equal to 10°, more preferably less than or equal to 5°, still more preferably less than or equal to 1°, and most preferably about 0°.

7. A method for preparing the superwetting surface according to any one of claims 1 to 6, comprising:

subjecting a monomer for forming the side group and a polypropylene surface having a micro-nano structure as the grafting base to grafting reaction by microwave irradiation, in the absence of an initiator.

8. The method according to claim 7, characterized in that the method includes any one of the following approaches 1) to 4):

1) contacting and mixing the polypropylene surface with the monomer for forming the hydrophilic side group, wherein an inorganic microwave absorbing medium is

optionally added; and then subjecting the resulting mixture to microwave irradiation grafting without the addition of an initiator; wherein the mixture optionally further comprises a monomer for lipophilic side group and an inorganic microwave absorbing medium;

2) contacting and mixing the polypropylene surface with the monomer for forming the hydrophilic side group, wherein an inorganic microwave absorbing medium is optionally added; then subjecting the resulting mixture to microwave irradiation grafting without the addition of an initiator; and then mixing the obtained grafted product with the monomer for forming the lipophilic side group and an inorganic microwave absorbing medium, and performing microwave irradiation grafting without the addition of an initiator;

3) contacting and mixing the polypropylene surface with the monomer for forming the lipophilic side group and an inorganic microwave absorbing medium, then subjecting the resulting mixture to microwave irradiation grafting without the addition of an initiator; then mixing the obtained grafted product with the monomer for forming the hydrophilic side group under the condition of optionally adding an inorganic microwave absorbing medium, and performing microwave irradiation grafting without the addition of an initiator;

4) in any one of the above 1)-3), when the monomer for forming the hydrophilic side group is at least one of an organic acid or an anhydride or ester thereof, further comprising the step of contacting and mixing the polypropylene surface grafted with at least one side group of an organic acid or an anhydride or ester thereof with a base; wherein, preferably, the base is one or more hydroxides, the hydroxide is preferably selected from the group consisting of metal hydroxides and ammonia water; wherein the metal hydroxide is preferably selected from the group consisting of sodium hydroxide, potassium hydroxide, barium hydroxide, lithium hydroxide, strontium hydroxide, calcium hydroxide, iron hydroxide, ferrous hydroxide, zinc hydroxide, magnesium hydroxide, cobalt hydroxide, gold hydroxide, aluminum hydroxide, copper hydroxide, beryllium hydroxide, rare earth hydroxide and combinations thereof, and preferably is selected from the group consisting of sodium hydroxide, potassium hydroxide, barium hydroxide, lithium hydroxide, strontium hydroxide, calcium hydroxide and combinations thereof; preferably, the amount of the base is 0.1-10% by weight based on the amount of the polypropylene surface; and preferably 1-8% by weight; preferably, the base is used in the form of an aqueous solution;

preferably, at least one of the above mixing processes is carried out under

vacuum.

9. The method according to claim 8, characterized in that the amount of the monomer for forming the hydrophilic side group is 0.1-10% by weight, preferably 1-8% by weight, based on the amount of the polypropylene surface; the monomer for forming the hydrophilic side group can be used in the form of a solution in which the monomer is dissolved in one or more solvents; preferably, the solvent is selected from the group consisting of alcohols, ketones, esters, water and combinations thereof.

10. The method according to claim 8 or 9, characterized in that the amount of the monomer for forming the lipophilic side group is 0.1-30% by weight, preferably 1-20% by weight, based on the amount of the polypropylene surface; the monomer for forming the lipophilic side group can be used in the form of a solution in which the monomer is dissolved in one or more solvents; preferably, the solvent is selected from the group consisting of alcohols, ketones, esters, water and combinations thereof.

11. The method according to any one of claims 7 to 10, characterized in that an inorganic microwave absorbing medium is added; preferably, the inorganic microwave absorbing medium is selected from the group consisting of metal hydroxides, metal salts, metal oxides, graphite materials, ferroelectric materials, electrolytic stone, chalcopyrite and combinations thereof; preferably, the metal hydroxide is selected from the group consisting of potassium hydroxide, barium hydroxide, sodium hydroxide, lithium hydroxide, strontium hydroxide, calcium hydroxide, iron hydroxide, ferrous hydroxide, zinc hydroxide, magnesium hydroxide, cobalt hydroxide, gold hydroxide, aluminum hydroxide, copper hydroxide, beryllium hydroxide, rare earth hydroxide and combinations thereof; the metal salt is selected from the group consisting of ammonium nitrate, potassium nitrate, sodium nitrate, barium nitrate, calcium nitrate, magnesium nitrate, aluminum nitrate, manganese nitrate, zinc nitrate, ferric nitrate, ferrous nitrate, copper nitrate, silver nitrate, ammonium chloride, potassium chloride, sodium chloride, barium chloride, calcium chloride, magnesium chloride, aluminum chloride, manganese chloride, zinc chloride, ferric chloride, ferrous chloride, copper chloride, ammonium sulfate, potassium sulfate, sodium sulfate, calcium sulfate, magnesium sulfate, aluminum sulfate, manganese sulfate, zinc sulfate, iron sulfate, ferrous sulfate, copper sulfate, silver sulfate, ammonium carbonate, potassium carbonate, sodium carbonate, magnesium carbonate, calcium carbonate, barium carbonate, potassium dihydrogen

phosphate, barium titanate, strontium titanate, copper calcium titanate and combinations thereof; the metal oxide is selected from the group consisting of ferric oxide, ferroferric oxide and combinations thereof; the graphite material is preferably selected from the group consisting of carbon black, graphite powder, graphene, reduction product of graphene oxide (the reducing agent is for example ascorbic acid), carbon nanotubes, activated carbon and combinations thereof; preferably, the amount of the inorganic microwave absorbing medium in single usage is 0.1-10% by weight, preferably 1-8% by weight of the amount of the polypropylene surface; preferably, the inorganic microwave absorbing medium is directly added, or is added in the form of a solution of dispersion in which it is dissolved or dispersed in one or more solvents; preferably, the one or more solvents are selected from the group consisting of alcohols, ketones, esters, water and combinations thereof; and preferably, the dispersion comprises a surfactant.

12. An article, constituted by the superwetting surface according to any one of claims 1 to 6, or comprising the superwetting surface according to any one of claims 1 to 6; wherein the article is preferably a film, sheet, plate, or molded article.

13. Use of the superwetting surface according to any one of claims 1 to 6 or the article according to claim 12 in bonding (such as bonding of plastic articles), spraying (such as spraying of the outer packaging of food bags, and spraying of the automobile bumper), oil-water separation, water treatment, biology, medicine or energy field.

14. Bonding, spraying, oil-water separation or water treatment method, wherein the superwetting surface according to any one of claims 1 to 6 or the article according to claim 12 is used.