CLAIMS

1. A method of producing a silica-based superhydrophilic film, the method comprising:

providing a coating formulation comprising an alkali metal silicate having a substantial portion of water removed therefrom, wherein the alkali metal silicate has a formula of $M_2O.nSiO_2$, wherein M represents an alkali metal and n is a positive real number greater than zero;

depositing the coating formulation on a substrate prior to (i) applying an alcohol to the coating formulation or (ii) contacting the coating formulation with an alcohol, wherein the alcohol comprises a curing agent, wherein the curing agent comprises an aqueous acid or an alkaline earth metal halide; and

drying the coating formulation to form the silica-based superhydrophilic film.

2. The method of claim 1, wherein n ranges from 0.4 to 40.

3. The method of claim 1 or 2, wherein providing the coating formulation comprises dissolving the alkali metal silicate in an aqueous solvent, wherein the aqueous solvent comprises water.

4. The method of any one of claims 1 to 3, wherein the alkali metal comprises potassium, sodium, or lithium.

5. The method of any one of claims 1 to 4, further comprises adding an aqueous amine stabilizer to the coating formulation and/or the alcohol prior to mixing the coating formulation and the alcohol.

6. The method of claim 5, wherein the aqueous amine stabilizer comprises methenamine in water, formamide in water, acetamide in water, or ethanolamine in water.

7. The method of any one of claims 1 to 6, further comprises adding silica particles to the coating formulation prior to mixing the coating formulation and the alcohol.

8. The method of any one claims 1 to 7, wherein the alcohol comprises methanol, ethanol, isopropanol, 1-propanol, butanol, or 2-methoxyethanol.

9. The method of any one of claims 1 to 8, wherein the aqueous acid comprises hydrochloric acid, sulfuric acid, phosphoric acid, nitric acid, or acetic acid.

10. The method of any one of claims 1 to 9, wherein the alkaline earth metal halide is soluble in the alcohol, and wherein the alkaline earth metal halide comprises calcium chloride or magnesium chloride.

11. The method of any one of claims 1 to 10, wherein mixing the coating formulation and the alcohol is carried out in a duration of 10 seconds or less.

12. The method of any one of claims 1 to 11, further comprising rinsing the silica-based superhydrophilic film with water before drying the coating formulation to form the silica-based superhydrophilic film.

13. The method of any one of claims 1 to 12, wherein drying the coating formulation to form the silica-based superhydrophilic film is carried out at a temperature ranging from 20°C to 150°C.

14. The method of any one of claims 1 to 13, further comprising annealing of the silica-based superhydrophilic film.

15. A silica-based superhydrophilic film produced according to a method of any one of claims 1 to 14, wherein the silica-based superhydrophilic film comprises an amine stabilizer.

16. The silica-based superhydrophilic film of claim 15, wherein the amine stabilizer comprises methenamine, formamide, acetamide, or ethanolamine.