CLAIMS

1. A surface treatment liquid for metal comprising an azole silane coupling agent, the surface treatment liquid further comprising:

(A) an organic acid ion having one to three acidic group(s) in one molecule;

(B) an inorganic acid ion;

(C) an alkali metal ion and/or an ammonium ion; and

(D) a copper ion.

2. The surface treatment liquid for metal according to claim 1, wherein an atomic concentration of silicon comprised in the surface treatment liquid is in a range of 0.010 to 0.50% by weight or 0.0004 to 0.36 mol/kg.

3. The surface treatment liquid for metal according to claim 1 or 2, wherein the organic acid ion comprised in the surface treatment liquid has a concentration in a range of 1.00 to 20.0% by weight or 0.0022 to 11.1 mol/kg.

4. The surface treatment liquid for metal according to any one of claims 1 to 3, wherein the inorganic acid ion comprised in the surface treatment liquid has a concentration in a range of 0.10 to 10.0% by weight or 0.010 to 1.04 mol/kg.

5. The surface treatment liquid for metal according to any one of claims 1 to 4, wherein a total concentration of the alkali metal ion and the ammonium ion comprised in the surface treatment liquid is in a range of 1.00 to 20.0% by weight or 0.43 to 8.70 mol/kg.

6. The surface treatment liquid for metal according to any one of claims 1 to 5, wherein the copper ion comprised in the surface treatment liquid has a concentration in a range of 0.001 to 0.200% by weight or 0.00002 to 0.16 mol/kg.

7. The surface treatment liquid for metal according to any one of claims 1 to 6, wherein the surface treatment liquid has a pH in a range of 1.0 to 12.0.

8. The surface treatment liquid for metal according to claims 1 to 7, wherein the azole silane coupling agent is one or more kinds of azole silane compounds selected from the group consisting of a monoazole silane compound, a diazole silane compound, a triazole silane compound, and a tetrazole silane compound.

9. The surface treatment liquid for metal according to any one of claims 1 to 8, wherein the acidic group is a carboxyl group, a sulfonic acid group, or a mixture thereof, and

the organic acid ion (A) is an organic acid anion in which the acidic group is anionized.

10. The surface treatment liquid for metal according to any one of claims 1 to 9, wherein the inorganic acid ion (B) is one or more kinds of ions selected from the group consisting of a sulfate ion, a nitrate ion, a phosphate ion, and a chloride ion.

11. The surface treatment liquid for metal according to any one of claims 1 to 10, wherein the alkali metal ion and/or ammonium ion (C) is one or more kinds of ions selected from the group consisting of a lithium ion, a sodium ion, a potassium ion, and an ammonium ion.

12. The surface treatment liquid for metal according to any one of claims 1 to 11, wherein the metal is a copper or a copper alloy.

13. The surface treatment liquid for metal according to any one of claims 1 to 12, wherein the metal is a metal circuit of a printed wiring board.

14. A liquid concentrate of a surface treatment liquid for metal, comprising an azole silane coupling agent,

the liquid concentrate further comprising an organic acid ion; an inorganic acid ion; an alkali metal ion and/or an ammonium ion; and a copper ion,

wherein an atomic concentration of silicon comprised in the liquid concentrate is in a range of 0.10 to 1.00% by weight.

15. The liquid concentrate of the surface treatment liquid for metal according to claim 14, wherein the surface treatment liquid for metal according to any one of claims 1 to 13 is produced by diluting the liquid concentrate of the surface treatment liquid for metal with water.

16. A surface treatment liquid set for metal, comprising a first liquid and a second liquid, for producing a surface treatment liquid for metal comprising an azole silane coupling agent, an organic acid ion, an inorganic acid ion, an alkali metal ion and/or an ammonium ion, and a copper ion by mutual mixing of the first liquid and the second liquid,

wherein

the azole silane coupling agent is comprised in the first liquid,

the organic acid ion, the inorganic acid ion, the alkali metal ion and/or the ammonium ion, and the copper ion are each independently comprised in the first liquid and/or the second liquid, and

an atomic concentration of silicon comprised in the first liquid is in a range of 0.033 to 1.00% by weight.

17. The surface treatment liquid set for metal according to claim 16, wherein the surface treatment liquid for metal is the surface treatment liquid for metal according to any one of claims 1 to 13.

18. A surface treatment method for metal, comprising bringing the surface treatment liquid for metal according to any one of claims 1 to 13 into contact with a surface of a metal.

19. A method for manufacturing a printed wiring board, the method comprising bringing the surface treatment liquid for metal according to any one of claims 1 to 13 into contact with a surface of a metal circuit of a printed wiring board to form a chemical film.