CLAIMS

1. A surface treatment agent for surface treatment of a workpiece, comprising the following components:

(I) at least one kind selected from the group consisting of silicon compounds represented by the following general formulas [1] and [2];

(II) at least one kind selected from the group consisting of a nitrogen-containing heterocyclic compound represented by the following general formula [3], a nitrogen-containing heterocyclic compound represented by the following general formula [4] and imidazole;

(III) an organic solvent; and

(IV) at least one kind selected from the group consisting of silicon compound represented by the following general formulas [5] and [6],

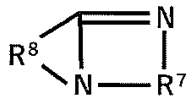
wherein the amount of the component (IV) contained relative to the amount of the component (I) is more than or equal to 0.001 and less than 1 in terms of molar ratio,

$$(R^1)_a(H)_bSi[N(R^2)C(=O)R^3]_{4-a-b} \quad [1]$$

where R^1 is each independently a C_1-C_{18} monovalent hydrocarbon group in which a part or all of hydrogen atoms may be substituted by a fluorine atom; R^2 is each independently a group selected from the group consisting of a C_1-C_6 alkyl group in which a part or all of hydrogen atoms may be substituted by a fluorine atom, and a hydrogen atom; R^3 is each independently a C_1-C_6 alkyl group in which a part or all of hydrogen atoms may be substituted by a fluorine atom; a is an integer of 1 to 3; b is an integer of 0 to 2; and the sum of a and b is 1 to 3,

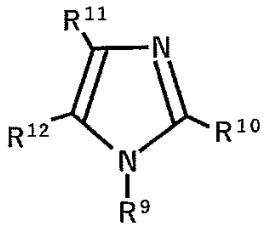
$$(R^4)_c(H)_dSi[OC(R^5)=NSi(R^6)_e(H)_{3-e}]_{4-c-d} \quad [2]$$

where R^4 and R^6 are each independently a C_1-C_{18} monovalent hydrocarbon group in which a part or all of hydrogen atoms may be substituted by a fluorine atom; R^5 is each independently a group selected from the group consisting of a C_1-C_6 alkyl group in which a part or all of hydrogen atoms may be substituted by a fluorine atom, and a hydrogen atom; c is an integer of 1 to 3; d is an integer of 0 to 2; e is an integer of 1 to 3; and the sum of c and d is 1 to 3,



[3]

where R^7 and R^8 are each independently a divalent organic group consisting of carbon and/or nitrogen and hydrogen, in which the total number of carbon and nitrogen atoms is 1 to 9; and, in the case where the total number of carbon and nitrogen atoms is 2 or greater, there may exit a carbon atom that does not form a ring,



[4]

where R^9 is a C_1-C_6 alkyl group in which a part of all of hydrogen atoms may be substituted by a fluorine atom, a trialkylsilyl group having a C_1-C_8 alkyl group in which a part of all of hydrogen atoms may be substituted by a fluorine atom, a C_2-C_6 alkenyl group in which a part of all of hydrogen atoms may be substituted by a fluorine atom, a C_1-C_6 alkoxy group in which a part of all of hydrogen atoms may be substituted by a fluorine atom, an amino group, an alkylamino group having a C_1-C_6 alkyl group in which a part of all of hydrogen atoms may be substituted by a fluorine atom, a dialkylamino group having a C_1-C_6 alkyl group in which a part of all of hydrogen atoms may be substituted by a fluorine atom, a C_1-C_6 aminoalkyl group in which a part of all of hydrogen atoms may be substituted by a fluorine atom, a nitro group, a cyano group, a phenyl group, a benzyl group, or a halogen atom; and R^{10}, R^{11} and R^{12} are each independently a C_1-C_6 alkyl group in which a part or all of hydrogen atoms may be substituted by a fluorine atom, or a hydrogen atom,

$$(R^{13})_f(H)_gSi[OC(=O)R^{14}]_{4-f-g} \quad [5]$$

where R^{13} is each independently a C_1-C_{18} monovalent hydrocarbon group in which a part or all of hydrogen atoms may be substituted by a fluorine atom; R^{14} is each independently a C_1-C_6 alkyl group in which a part or all of hydrogen atoms may be substituted by a fluorine atom; f is an integer of 1 to 3; g is an integer of 0 to 2; and the sum of f and g is 1 to 3,

$$(R^{15})_h(H)_iSiX_{4-h-i} \quad [6]$$

where R^{15} is each independently a C_1-C_{18} monovalent hydrocarbon group in which a part or all of hydrogen atoms may be substituted by a fluorine atom; X is each independently a halogen atom, an alkylsulfonate group, or a perfluoroalkylsulfonate group; h is an integer of 1 to 3; i is an integer of 0 to 2; and the sum of h and i is 1 to 3.

~~2. The surface treatment agent according to claim 1, wherein the amount of the component (IV) contained relative to the amount of the component (I) is more than or equal to 0.001 and less than 1 in terms of molar ratio.~~

~~3~~2. The surface treatment agent according to claim 1~~ or 2~~, wherein the component (IV) comprises at least one kind of silicon compound represented by the general formula [5] in which f is 3; and R^{14} is a C_1-C_6 fluorine-containing alkyl group.

~~4~~3. The surface treatment agent according to ~~any one of claims 1 to 3~~claim 1 or 2, wherein the component (IV) comprises $(CH_3)_3SiOC(=O)CF_3$.

~~5~~4. The surface treatment agent according to any one of claims 1 to ~~4~~3, wherein the component (IV) comprises a silicon compound represented by the general formula [6] in which h is 3; i is 0; and R15 is a C_1-C_6 alkyl group or a C_1-C_6 fluorine-containing alkyl group.

~~6~~5. The surface treatment agent according to any one of claims 1 to ~~5~~4, wherein the component (IV) comprises a silicon compound represented by the general formula [6] in which X is a chlorine atom.

~~7~~6. The surface treatment agent according to any one of claims 1 to ~~6~~5, wherein the component (IV) comprises $(CH_3)_3SiCl$.

~~8~~7. The surface treatment agent according to any one of claims 1 to ~~7~~6, wherein the concentration of the component (II) is 0.05 to 10 mass% with respect to the total

amount of the components (I) to (IV).

~~9~~8. The surface treatment agent according to any one of claims 1 to ~~8~~7, wherein the component (II) is liquid at 25°C and 1.0 atmospheric pressure.

~~10~~9. The surface treatment agent according to any one of claims 1 to ~~9~~8, wherein, in the general formula [4], R^9 is a C_1-C_4 alkyl group or a trimethylsilyl group, and R^{10}, R^{11} and R^{12} are hydrogen atoms, respectively.

~~11~~10. The surface treatment agent according to any one of claims 1 to ~~10~~9, wherein the component (II) is at least one selected from the group consisting of N-methylimidazole, N-ethylimidazole, N-propylimidazole, N-butylimidazole and trimethylsilylimidazole.

~~12~~11. The surface treatment agent according to any one of claims 1 to ~~11~~10, wherein the concentration of the component (I) is 0.1 to 35 mass% with respect to the total amount of the components (I) to (IV).

~~13~~12. The surface treatment agent according to any one of claims 1 to ~~12~~11, wherein the component (I) comprises at least one kind of silicon compound represented by the general formula [1] in which a is 3; R^2 is a methyl group; and R^3 is a C_1-C_6 fluorine-containing alkyl group.

~~14~~13. The surface treatment agent according to any one of claims 1 to ~~13~~12, wherein the component (I) comprises $(CH_3)_3SiN(CH_3)C(=O)CF_3$.

~~15~~14. The surface treatment agent according to any one of claims 1 to ~~15~~13, wherein the component (I) comprises at least one kind of silicon compound represented by the general formula [2] in which c and e are each 3; and R^5 is a methyl group or a trifluoromethyl group.

~~16~~15. The surface treatment agent according to any one of claims 1 to ~~15~~14, wherein

the component (I) comprises $(CH_3)_3SiOC(CF_3)=NSi(CH_3)_3$.

~~17~~16. The surface treatment agent according to any one of claims 1 to ~~16~~15, wherein the organic solvent is an aprotic solvent.

~~18~~17. A method for manufacturing a surface treated body, comprising bringing the surface treatment agent according to any one of claims 1 to ~~17~~16 into contact with a surface of a workpiece and thereby surface treating the workpiece.