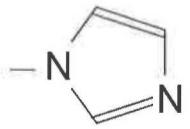
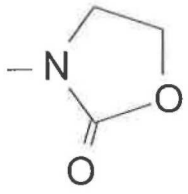
hydrocarbon group the hydrogen elements of which may partially or entirely be replaced with a fluorine element(s), "j" is an integer of 1 or 2, and "k" is an integer of from 0 to 2) and the like.



[15]



[16]



[17]

[0058] The monovalent functional group of which element to be bonded to silicon element is oxygen, which is one example of X^1 of the general formula [1], may include not only hydrogen element, carbon element, nitrogen element and oxygen element but also silicon element, sulfur element and halogen element and the like. Examples of the functional~~organic~~ group are an alkoxy group, $-OC(CH_3)=CHCOCH_3$, $-OC(CH_3)=N-Si(CH_3)_3$, $-OC(CF_3)=N-Si(CH_3)_3$, $-O-CO-R^{21}$ (where R^{21} is a C_1-C_{18} monovalent hydrocarbon group the hydrogen elements of which may partially or entirely be replaced with a fluorine element(s)) and an alkyl sulfonate group the hydrogen elements of which may partially or entirely be replaced with a fluorine element(s) and the like.

[0059] Additionally, a halogen group, which is one example of X^1 of the general formula [1], is exemplified by a chloro group, bromo group, iodo group and the like.

[0060] In addition, R^1 of the general formula [1] serves as a hydrophobic moiety which decreases a surface energy of an article to reduce the interaction caused between water or another liquid and the article surface (i.e., at the interface), such as hydrogen bond, intermolecular forces and the like. The effect of reducing the interaction is particularly exhibited with water, but the effect of reducing the interaction is exhibited also with a mixture liquid of water and a liquid other than water or with a liquid other than water. With this, the contact angle of the liquid to the article surface can be increased.

[0061] Examples of the silylation reagent represented by the general

[0135] [Table 4]

	Metal impurity Concentration (mass ppb)													Number of Particles (per 1 mL)
	Na	Mg	K	Ca	Mn	Fe	Cu	Li	Al	Cr	Ni	Zn	Ag	
Example 10	0.04	<0.03	<0.03	<0.08	<0.001	0.03	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	6
Example 11	0.05	<0.03	<0.03	<0.08	<0.001	0.04	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	16
Example 12	0.02	<0.03	<0.03	<0.08	<0.001	0.02	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	8
Example 13	0.02	<0.03	<0.03	<0.08	<0.001	0.02	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	4
Example 14	0.02	<0.03	<0.03	<0.08	<0.001	0.02	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	3
Example 15	0.02	<0.03	<0.03	<0.08	<0.001	0.02	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	9
Example 16	0.03	<0.03	<0.03	<0.08	<0.001	0.03	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	11
Example 17	0.02	<0.03	<0.03	<0.08	<0.001	0.02	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	5
Example 18	0.02	<0.03	<0.03	<0.08	<0.001	<0.02	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	5
Example 19	0.06	<0.03	0.04	<0.08	<0.001	0.05	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	9
Example 20	0.08	<0.03	0.08	0.08	0.005	0.07	0.027	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	7
Example 21	0.07	<0.03	0.07	<0.08	0.003	0.05	0.019	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	9
Example 22	0.04	<0.03	<0.03	<0.08	<0.001	0.03	<0.003	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	7
Comparative Example 3	0.07	<0.03	0.06	<0.08	0.002	0.06	0.018	<0.001	<0.03	<0.05	<0.002	<0.04	<0.004	360
Comparative Example 4	0.56	0.25	0.3	0.38	0.021	0.38	0.091	<0.001	<0.03	0.07	<0.002	<0.04	<0.004	900

[0136] [Example 11]

The first refinement step was carried out by distilling iPA under a condition of 120°C and 101~~760~~ kPa under atmospheric pressure to eliminate metal impurities from the solvent. Likewise, the first refinement step was carried out by distilling DGEEA under a condition of 160°C and under a reduced pressure of 5 kPa to eliminate metal impurities from the solvent. In a mixing step, 9 g of iPA of after the first refinement step, 9990 g of DGEEA of after the first refinement step and 1 g of FHEPA as an agent for forming a water-repellent protective film were mixed. Furthermore, a second refinement step was conducted by one-pass filtration system where the liquid chemical of after the mixing step was permeated through an ion exchange resin membrane (ION CLEAN SL No. DFA1SRPESW44 produced by Pall Corporation, Surface area: 1100 cm^2, Number of filter: 2) and a

electrically conductive pipe, PFA was employed. The charged electric potential of the obtained liquid chemical was 0.5 kV. The conditions for preparing the liquid chemical are shown in Table 7 and the results of evaluating the obtained liquid chemical are shown in Table 8.

[0172] [Example 51]

The first refinement step was carried out by distilling iPA under a condition of 120°C and 101~~760~~ kPa under atmospheric pressure to eliminate metal impurities from the solvent. Likewise, the first refinement step was carried out by distilling DGEEA under a condition of 160°C and under a reduced pressure of 5 kPa to eliminate metal impurities from the solvent. With the exception of the above, the procedure of Example 50 was repeated thereby obtaining a liquid chemical for forming a protective film from which metal impurities and particles have been eliminated. The charged electric potential of the obtained liquid chemical was 0.6 kV. The conditions for preparing the liquid chemical are shown in Table 7 and the results of evaluating the obtained liquid chemical are shown in Table 8.

[0173] [Example 52]

The procedure of Example 50 was repeated with the exception that an ion exchange resin membrane with particle-eliminating membrane having a particle-eliminating diameter of 0.05 μm (Protego Plus LTX No. PRLZ02PQ1K produced by Nihon Entegris K.K., Surface area: 1.38 m^2, Number of filter: 4) was used in the second refinement step, thereby obtaining a liquid chemical for forming a protective film. The conditions for preparing the liquid chemical are shown in Table 7 and the results of evaluating the obtained liquid chemical are shown in Table 8.

[0174] [Example 53]

The first refinement step of Example 50 was not performed. In a third refinement step, a liquid chemical of after the mixing step was refined by being permeated through the same ion exchange resin membrane with particle-eliminating membrane as that used in the second refinement step of Example 50. However, metal impurities contained in the liquid chemical

N-alkylmorpholine and a silane compound represented by the following general formula [5].

$(R^7)_eSi(H)_fX^3_{4-e-f}$ [5]

[In the formula [5], R^7 mutually independently represents a C_1-C_{18} monovalent hydrocarbon group the hydrogen elements of which may partially or entirely be replaced with a fluorine element(s); X^3 mutually independently represents a monovalent functional group of which element to be bonded to a silicon element is nitrogen, the monovalent functional group possibly containing a fluorine element and/or a silicon element; "e" is an integer of from 1 to 3; "f" is an integer of from 0 to 2; and the total of "e" and "f" is 1 to 3.]

[Claim 8] A method for preparing a liquid chemical for forming a water-repellant protective film, as claimed in any of claims 5 to 7, characterized in that the solvent comprises at least one selected from the group consisting of hydrocarbons, esters, ethers, ketones, halogen-containing solvents, sulfoxide-based solvents, lactone-based solvents, carbonate-based solvents, polyalcohol derivatives having no OH group, and nitrogen element-containing solvents having no N–H group.

[Claim 9] A method for preparing a liquid chemical for forming a water-repellant protective film ~~on a wafer~~, as claimed in any of claims 1 to 4, characterized in that the agent for forming a water-repellant protective film comprises at least one kind selected from the group consisting of compounds represented by the following general formulas [6] to [13] and their salts.

R^8–$P(=O)(OH)_g(R^9)_{2-g}$ [6]

[In the formula [6], R^8 represents a C_1-C_{18} monovalent hydrocarbon group the hydrogen elements of which may partially or entirely be replaced with a fluorine element(s); R^9 mutually independently represents a monovalent organic group having a C_1-C_3 hydrocarbon group the hydrogen elements of which may partially or entirely be replaced with a fluorine element(s); and "g" is an integer of from 0 to 2.]

[Claim 20] A method for preparing a liquid chemical kit for forming a water-repellant protective film, as claimed in any of claims 12 to 18, characterized in that the base comprises at least one selected from the group consisting of ammonia, N,N,N',N'-tetramethylethylenediamine, triethylenediamine, dimethylaniline, alkylamine, dialkylamine, trialkylamine, pyridine, piperazine, N-alkylmorpholine and a silane compound represented by the following general formula [5].

$$(R^7)_eSi(H)_fX^3_{4-e-f} \qquad [5]$$

[In the formula [5], R^7 mutually independently represents a C_1-C_{18} monovalent hydrocarbon group the hydrogen elements of which may partially or entirely be replaced with a fluorine element(s); X^3 mutually independently represents a monovalent functional group of which element to be bonded to a silicon element is nitrogen, the monovalent functional group possibly containing a fluorine element and/or a silicon element; "e" is an integer of from 1 to 3; "f" is an integer of from 0 to 2; and the total of "e" and "f" is 1 to 3.]

[Claim 21] A liquid chemical kit for forming a water-repellant protective film, prepared through the steps of the method for preparing a liquid chemical kit for forming a water-repellant protective film, as claimed in any of claims 12 to 20.