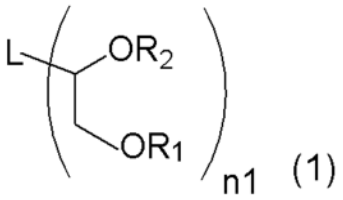
CLAIMS

[Claim 1] A composition for forming an organic film, comprising:

(A) a resin or compound for forming an organic film;

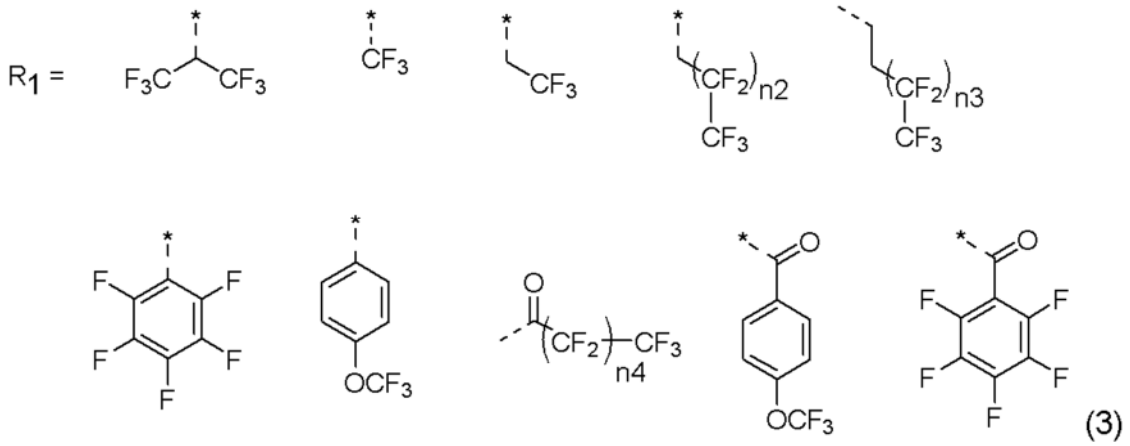
(B) a fluorine-containing compound represented by the following general formula (1), a structure of the fluorine-containing compound being a structure not having nitrogen; and

(C) a solvent,



(1)

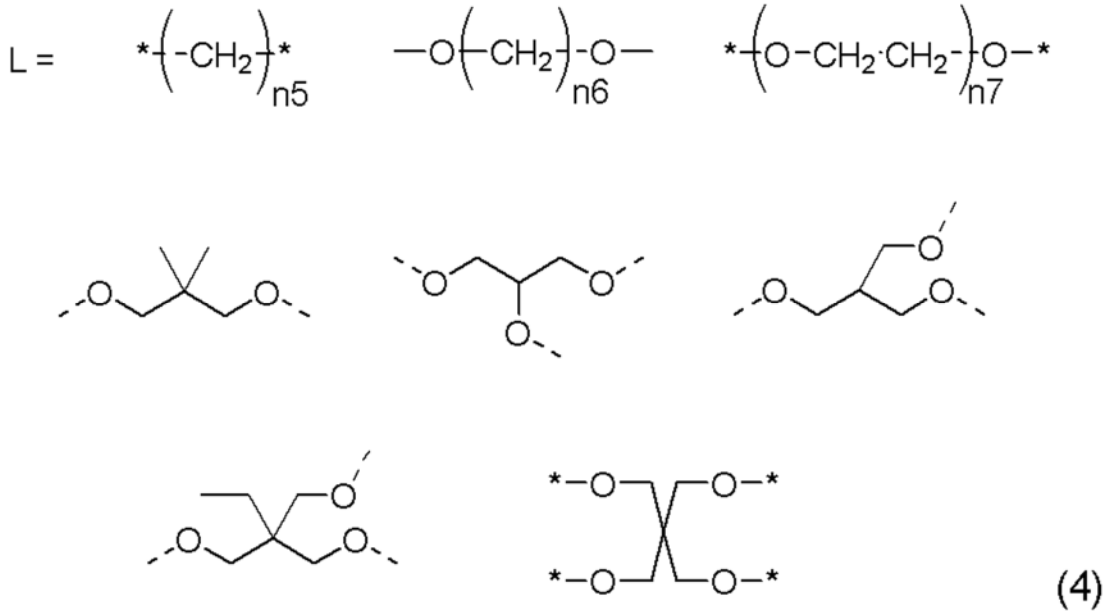
wherein L represents a single bond or an n1-valent organic group having 1 to 50 carbon atoms, R_1 has a structure represented by any of the following general formulae (3), R_2 represents a hydrogen atom or a monovalent organic group having 1 to 30 carbon atoms, and “n1” represents an integer of 2 to 8,



(3)

wherein “*” represents an attachment point in the organic group represented by the R_1; and “n2”, “n3”, and “n4” each represent an integer of 1 to 10.

[Claim 2] The composition for forming an organic film according to claim 1, wherein the L in the general formula (1) is an organic group represented by any of the following general formulae (4),



(4)

wherein "*" represents an attachment point to a terminal structure including the OR_1 and the OR_2; and "n5", "n6", and "n7" each represent an integer of 1 to 10.

[Claim 3] The composition for forming an organic film according to any one of claims 1 or 2, wherein the R_2 in the general formula (1) is a hydrogen atom.

[Claim 4] The composition for forming an organic film according to any one of claims 1 to 3, wherein the fluorine-containing compound (B) represented by the general formula (1) has a weight-average molecular weight of 300 to 1500.

[Claim 5] The composition for forming an organic film

according to any one of claims 1 to 4, wherein the fluorine-containing compound (B) represented by the general formula (1) satisfies $1.00 \leq Mw/Mn \leq 1.10$, where Mw is a weight-average molecular weight and Mn is a number-average molecular weight measured by gel permeation chromatography in terms of polystyrene.

[Claim 6] The composition for forming an organic film according to any one of claims 1 to 5, wherein the fluorine-containing compound (B) is contained in an amount of 0.01 parts by mass to 5 parts by mass based on 100 parts by mass of the resin or compound (A) for forming an organic film.

[Claim 7] A method for forming an organic film to be used in a manufacturing process of a semiconductor device, the method comprising:

spin-coating a substrate to be processed with the composition for forming an organic film according to any one of claims 1 to 6 to obtain a coating film; and

forming a cured film by heating the coating film at a temperature of 100°C or higher and 600°C or lower for 10 to 600 seconds.

[Claim 8] A patterning process comprising:

forming an organic underlayer film on a body to be processed by using the composition for forming an organic film according to any one of claims 1 to 6;

forming a resist middle layer film on the organic underlayer film by using a resist middle layer film material containing a silicon atom;

forming a resist upper layer film on the resist middle layer film by using a resist upper layer film

material comprising a photoresist composition;

forming a circuit pattern in the resist upper layer film;

transferring the pattern to the resist middle layer film by etching while using the resist upper layer film having the formed circuit pattern as a mask;

transferring the pattern to the organic underlayer film by etching while using the resist middle layer film having the transferred pattern as a mask; and

further transferring the pattern to the body to be processed by etching while using the organic underlayer film having the transferred pattern as a mask.

[Claim 9] A patterning process comprising:

forming an organic underlayer film on a body to be processed by using the composition for forming an organic film according to any one of claims 1 to 6;

forming a resist middle layer film on the organic underlayer film by using a resist middle layer film material containing a silicon atom;

forming an organic antireflective film or an adhesive film on the resist middle layer film;

forming a resist upper layer film on the organic antireflective film or the adhesive film by using a resist upper layer film material comprising a photoresist composition;

forming a circuit pattern in the resist upper layer film;

transferring the pattern to the organic antireflective film or the adhesive film and to the resist middle layer film by etching while using the resist upper layer film having the formed circuit pattern as a mask;

transferring the pattern to the organic underlayer film by etching while using the resist middle layer film having the transferred pattern as a mask; and

further transferring the pattern to the body to be processed by etching while using the organic underlayer film having the transferred pattern as a mask.

[Claim 10] A patterning process comprising:

forming an organic underlayer film on a body to be processed by using the composition for forming an organic film according to any one of claims 1 to 6;

forming an inorganic hard mask selected from the group consisting of a silicon oxide film, a silicon nitride film, and a silicon oxynitride film on the organic underlayer film;

forming a resist upper layer film on the inorganic hard mask by using a resist upper layer film material comprising a photoresist composition;

forming a circuit pattern in the resist upper layer film;

transferring the pattern to the inorganic hard mask by etching while using the resist upper layer film having the formed circuit pattern as a mask;

transferring the pattern to the organic underlayer film by etching while using the inorganic hard mask having the transferred pattern as a mask; and

further transferring the pattern to the body to be processed by etching while using the organic underlayer film having the transferred pattern as a mask.

[Claim 11] A patterning process comprising:

forming an organic underlayer film on a body to be processed by using the composition for forming an

organic film according to any one of claims 1 to 6;

forming an inorganic hard mask selected from the group consisting of a silicon oxide film, a silicon nitride film, and a silicon oxynitride film on the organic underlayer film;

forming an organic antireflective film or an adhesive film on the inorganic hard mask;

forming a resist upper layer film on the organic antireflective film or the adhesive film by using a resist upper layer film material comprising a photoresist composition;

forming a circuit pattern in the resist upper layer film;

transferring the pattern to the organic antireflective film or the adhesive film and to the inorganic hard mask by etching while using the resist upper layer film having the formed circuit pattern as a mask;

transferring the pattern to the organic underlayer film by etching while using the inorganic hard mask having the transferred pattern as a mask; and

further transferring the pattern to the body to be processed by etching while using the organic underlayer film having the transferred pattern as a mask.

[Claim 12] The patterning process according to claim 10 or 11, wherein the inorganic hard mask is formed by a CVD method or an ALD method.

[Claim 13] The patterning process according to any one of claims 8 to 12, wherein the circuit pattern is formed by a lithography using light having a wavelength of 10 nm or more and 300 nm or less, a direct writing with

electron beam, nanoimprinting, or a combination thereof.

[Claim 14] The patterning process according to any one of claims 8 to 13, wherein the circuit pattern is developed with an alkaline development or an organic solvent.

[Claim 15] The patterning process according to any one of claims 8 to 14, wherein the body to be processed is a semiconductor device substrate or the semiconductor device substrate coated with any of a metal film, a metal carbide film, a metal oxide film, a metal nitride film, a metal oxycarbide film, and a metal oxynitride film.

[Claim 16] The patterning process according to claim 15, wherein the metal constituting the body to be processed is silicon, titanium, tungsten, hafnium, zirconium, chromium, germanium, copper, silver, gold, aluminum, indium, gallium, arsenic, palladium, iron, tantalum, iridium, molybdenum, or an alloy thereof.