WHAT IS CLAIMED IS:

1. A method of processing a substrate, comprising:

(a) supplying a fluorine-containing gas to the substrate including a first surface and a second surface;

(b) supplying an oxygen- and hydrogen-containing gas and a catalyst to the substrate after performing (a);

(c) supplying an organic modifying agent containing one or more atoms, to which a first functional group and a second functional group are directly bonded in a molecule, to the substrate after performing (b); and

(d) supplying a film-forming agent to the substrate after performing (c),

wherein the first surface is formed of an oxide film and a native oxide film is formed on the second surface,

wherein the catalyst includes an amine-based gas,

wherein the molecule constituting the organic modifying agent is of a molecular structure in which an amino group and an alkyl group are directly bonded to Si, and

wherein the film-forming agent includes a Si- and halogen-containing gas.

2. The method of Claim 1, wherein in (a), the native oxide film formed on the second surface is removed, and

wherein in (b), fluorine adsorbed on a surface of the substrate is removed and an OH termination is formed on the first surface.

3. The method of Claim 1, wherein (b) is performed under a condition that formation of an OH termination on the second surface is suppressed and an OH termination is formed on the first surface.

4. The method of Claim 1, wherein (b) is performed under a condition that oxidation of the second surface is suppressed and an OH termination is formed on the first surface.

5. The method of Claim 1, wherein (b) is performed under a condition that an amount of OH termination formed on the second surface is smaller than an amount of OH termination formed on the first surface.

6. The method of Claim 1, wherein in (c), the first surface is modified to form a film-formation inhibiting layer by adsorbing at least a portion of the molecular structure of molecules constituting the organic modifying agent on the first surface.

7. The method of Claim 1, wherein in (d), a film is formed on the second surface.

8. The method of Claim 1, wherein the film-forming agent includes a precursor, a catalyst, and an oxidizing agent.

9. The method of Claim 8, wherein (d) includes performing a cycle a predetermined number of times, the cycle including non-simultaneously performing:

(d1) supplying the precursor or the precursor and the catalyst to the substrate; and

(d2) supplying the oxidizing agent and the catalyst to the substrate.

10. The method of Claim 9, wherein the oxidizing agent is an oxygen- and hydrogen-containing gas, and

wherein a condition for supplying the oxygen- and hydrogen-containing gas and the catalyst in (b) is set to be different from a condition for supplying the oxidizing agent and the catalyst in (d2).

11. The method of Claim 9, wherein the oxidizing agent is an oxygen- and hydrogen-containing gas, and

wherein a time for supplying the oxygen- and hydrogen-containing gas and the catalyst in (b) is set to be longer than a time for supplying the oxidizing agent and the catalyst in (d2).

12. The method of Claim 1, wherein (a), (b), (c), and (d) are performed in a same process chamber.

13. The method of Claim 1, wherein the first surface contains an oxygen-containing material, and the second surface contains an oxygen-free material.

14. The method of Claim 1, wherein the fluorine-containing gas is HF gas, and the oxygen- and hydrogen-containing gas is H_2O gas.

15. A method of manufacturing a semiconductor device comprising:

(a) supplying a fluorine-containing gas to a substrate including a first surface and a second surface;

(b) supplying an oxygen- and hydrogen-containing gas and a catalyst to the substrate after performing (a);

(c) supplying a modifying agent to the substrate after performing (b); and

(d) supplying a film-forming agent to the substrate after performing (c).

16. A substrate processing apparatus comprising:

a process chamber in which a substrate is processed;

a fluorine-containing gas supply system configured to supply a fluorine-containing gas to the substrate in the process chamber;

an oxygen- and hydrogen-containing gas supply system configured to supply an

oxygen- and hydrogen-containing gas to the substrate in the process chamber;

a catalyst supply system configured to supply a catalyst to the substrate in the process chamber;

a modifying agent supply system configured to supply an organic modifying agent to the substrate in the process chamber;

a film-forming agent supply system configured to supply a film-forming agent to the substrate in the process chamber; and

a controller configured to be capable of controlling the fluorine-containing gas supply system, the oxygen- and hydrogen-containing gas supply system, the catalyst supply system, the modifying agent supply system, and the film-forming agent supply system so as to perform in the process chamber:

(a) supplying the fluorine-containing gas to the substrate including a first surface and a second surface;

(b) supplying the oxygen- and hydrogen-containing gas and the catalyst to the substrate after performing (a);

(c) supplying an organic modifying agent containing one or more atoms, to which a first functional group and a second functional group are directly bonded in a molecule, to the substrate after performing (b); and

(d) supplying the film-forming agent to the substrate after performing (c),

wherein the first surface is formed of an oxide film and a native oxide film is formed on the second surface,

wherein the catalyst includes an amine-based gas,

wherein the molecule constituting the organic modifying agent is of a molecular structure in which an amino group and an alkyl group are directly bonded to Si, and

wherein the film-forming agent includes a Si- and halogen-containing gas.

17. A non-transitory computer-readable recording medium storing a program that causes, by

a computer, a substrate processing apparatus to perform:

(a) supplying a fluorine-containing gas to a substrate including a first surface and a second surface;

(b) supplying an oxygen- and hydrogen-containing gas and a catalyst to the substrate after performing (a);

(c) supplying an organic modifying agent containing one or more atoms, to which a first functional group and a second functional group are directly bonded in a molecule, to the substrate after performing (b); and

(d) supplying a film-forming agent to the substrate after performing (c),

wherein the first surface is formed of an oxide film and a native oxide film is formed on the second surface,

wherein the catalyst includes an amine-based gas,

wherein the molecule constituting the organic modifying agent is of a molecular structure in which an amino group and an alkyl group are directly bonded to Si, and

wherein the film-forming agent includes a Si- and halogen-containing gas.

18. The method of Claim 1, wherein while (a) is performed, the oxygen- and hydrogen-containing gas and the catalyst are supplied to the substrate.