

[CLAIMS]

[Claim 1]

A method of manufacturing a semiconductor device comprising:

5 a first step of modifying a silazane-bond containing film, whose thickness is greater than 400 nm, into a silicon oxide film by supplying a first process gas containing hydrogen peroxide to a substrate with the silazane-bond containing film formed on a surface thereof; and

a second step of removing an OH group bonded or coordinated to Si-O chain
10 from the silicon oxide film by supplying a second process gas containing a compound containing an NH group to the substrate after the first step.

[Claim 2]

The method of claim 1, wherein a temperature of the substrate is equal to or less
15 than 120 °C in the first step.

[Claim 3]

The method of claim 1, wherein the silazane-bond containing film comprises a polysilazane film.
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[Claim 4]

The method of claim 1, wherein the thickness of the silazane-bond containing film is greater than 4 μm.

[Claim 5]

The method of claim 4, wherein a temperature of the substrate is less than 200 °C in the first step.

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[Claim 6]

The method of claim 1, wherein the compound containing the NH group is at least one compound selected from the group consisting of ammonia, methylamine, dimethylamine and trimethylamine.

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[Claim 7]

The method of claim 1, wherein a temperature of the substrate is equal to or less than 400 °C in the second step.

15 [Claim 8]

The method of claim 7, wherein the temperature of the substrate is equal to or greater than 150 °C and equal to or less than 300 °C in the second step.

[Claim 9]

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A substrate processing apparatus comprising:
a process chamber configured to accommodate a substrate;
a first process gas supply system configured to supply a first process gas containing hydrogen peroxide into the process chamber;

a second process gas supply system configured to supply a second process gas containing a compound containing an NH group into the process chamber; and

a controller configured to control the first process gas supply system and the second process gas supply system to perform:

5 a first process of modifying a silazane-bond containing film, whose thickness is greater than 400 nm, into a silicon oxide film by supplying the first process gas containing the hydrogen peroxide to the substrate with the silazane-bond containing film formed on a surface thereof; and

 a second process of removing an OH group bonded or coordinated to
10 Si-O chain from the silicon oxide film by supplying the second process gas containing the compound containing the NH group to the substrate after the first process.

[Claim 10]

A non-transitory computer-readable recording medium storing a program that
15 causes, by a computer, a substrate processing apparatus to perform:

a first sequence of modifying a silazane-bond containing film, whose thickness is greater than 400 nm, into a silicon oxide film by supplying a first process gas containing hydrogen peroxide to a substrate with the silazane-bond containing film formed on a surface thereof; and

20 a second sequence of removing an OH group bonded or coordinated to Si-O chain from the silicon oxide film by supplying a second process gas containing a compound containing an NH group to the substrate after the first sequence.

[Claim 11]

The method of claim 1, wherein the second process gas is supplied to the substrate at equal to or greater than 700 hPa and equal to or less than 1,000 hPa in the second step.