

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device, comprising:
a first act of modifying a film containing a silazane bond by heating a substrate, in which the film containing the silazane bond is formed over a surface of the substrate, to a first temperature and by supplying a first processing gas containing hydrogen peroxide to the substrate; and
after the first act, a second act of modifying the film containing the silazane bond by heating the substrate to a second temperature higher than the first temperature and by supplying a second processing gas, which contains hydrogen peroxide and has a concentration of the hydrogen peroxide higher than a concentration of the hydrogen peroxide of the first processing gas, to the substrate.
2. The method according to Claim 1, wherein the film containing the silazane bond is made of polysilazane.
3. The method according to Claim 1, wherein in the first act, a state in which the substrate is heated to the first temperature is maintained for a predetermined time.
4. The method according to Claim 1, wherein in the second act, a state in which the substrate is heated to the second temperature is maintained for a predetermined time.
5. The method according to Claim 1, wherein a period during which the first act is performed is set equal to or longer than a period during which the second act is performed.
6. The method according to Claim 1, wherein in the first act, the first temperature is set at a predetermined temperature which falls within a range that is higher than or equal to 70 degrees C

and lower than 300 degrees C, and

wherein the first act is performed at least until the hydrogen peroxide is permeated into the film over an entire region of the film containing the silazane bond in a thickness direction.

7. The method according to Claim 1, further comprising, between the first act and the second act, a third act of not performing a supply of a gas containing hydrogen peroxide to the substrate.

8. The method according to Claim 7, wherein in the third act, an oxygen-containing gas not containing hydrogen peroxide is supplied to the substrate.

9. The method according to Claim 1, wherein the first temperature is set at a predetermined temperature which falls within a range that is higher than or equal to 70 degrees C and lower than 300 degrees C.

10. The method according to Claim 1, wherein the second temperature is set at a predetermined temperature which falls within a range that is higher than or equal to 300 degrees C and lower than or equal to 500 degrees C.

11. The method according to Claim 1, wherein the second temperature is set at a predetermined temperature higher than the first temperature by 100 degrees C or greater.

12. The method according to Claim 1, further comprising, after the second act, a fourth act of drying the substrate by supplying an oxygen-containing gas not containing hydrogen peroxide to the substrate.

13. The method according to Claim 12, wherein the fourth act is performed in a state in

which a temperature of the substrate is maintained at the second temperature.

14. A substrate processing apparatus, comprising:

a process chamber configured to accommodate a substrate;

a heater configured to heat the substrate in the process chamber;

a gas supply system configured to supply a first processing gas containing hydrogen peroxide and a second processing gas, which contains hydrogen peroxide and has a concentration of the hydrogen peroxide higher than a concentration of the hydrogen peroxide of the first processing gas, into the process chamber; and

a controller configured to control the heater and the gas supply system so as to execute:

a first process of modifying a film containing a silazane bond by heating the substrate, in which the film containing the silazane bond is formed over a surface of the substrate, to a first temperature and by supplying the first processing gas to the substrate; and

after the first process, a second process of modifying the film containing the silazane bond by heating the substrate to a second temperature higher than the first temperature and by supplying the second processing gas to the substrate.

15. A program that causes, by a computer, a substrate processing apparatus to perform a process in a process chamber of the substrate processing apparatus, the process comprising:

a first act of modifying a film containing a silazane bond by heating a substrate, in which the film containing the silazane bond is formed over a surface of the substrate, to a first temperature and by supplying a first processing gas containing hydrogen peroxide to the substrate; and

after the first act, a second act of modifying the film containing the silazane bond by heating the substrate to a second temperature higher than the first temperature and by supplying a second processing gas, which contains hydrogen peroxide and has a concentration of the

hydrogen peroxide higher than a concentration of the hydrogen peroxide of the first processing gas, to the substrate.