

WHAT IS CLAIMED IS:

1. A substrate processing apparatus, comprising:
 - a process chamber configured to accommodate a substrate;
 - a vaporizer configured to vaporize a liquid precursor to generate a reaction gas and deliver a processing gas containing the reaction gas and a carrier gas, the vaporizer including:
 - a vaporization vessel in which the liquid precursor is vaporized;
 - a liquid precursor introduction part configured to introduce the liquid precursor into the vaporization vessel;
 - a carrier gas introduction part configured to introduce the carrier gas into the vaporization vessel; and
 - a heater configured to heat the liquid precursor introduced into the vaporization vessel,
 - a carrier gas supply controller configured to control a supply amount of the carrier gas supplied to the vaporizer;
 - a liquid precursor supply controller configured to control a supply amount of the liquid precursor supplied to the vaporizer;
 - a processing gas supply pipe configured to introduce the processing gas delivered from the vaporizer into the process chamber;
 - a processing gas temperature sensor configured to detect a temperature of the processing gas delivered from the vaporizer into the processing gas supply pipe; and
 - a controller configured to control the heater to adjust a temperature of the heater, based on the temperature of the processing gas detected by the processing gas temperature sensor.
2. The apparatus of Claim 1, comprising a processing gas pressure sensor configured to detect a pressure of the processing gas in the processing gas supply pipe,
 - wherein the controller is configured to control the heater to adjust the temperature of the heater based on the pressure of the processing gas detected by the processing gas pressure sensor

and the temperature of the processing gas detected by the processing gas temperature sensor.

3. The apparatus of Claim 1, comprising a gas concentration sensor configured to detect a gas concentration of the reaction gas contained in the processing gas delivered from the vaporizer into the processing gas supply pipe,

wherein the controller is configured to control the heater to adjust the temperature of the heater based on the gas concentration of the reaction gas detected by the gas concentration sensor and the temperature of the processing gas detected by the processing gas temperature sensor.

4. The apparatus of Claim 1, wherein the controller is configured to control the heater to adjust the temperature of the heater based on the temperature of the processing gas detected by the processing gas temperature sensor and control the carrier gas supply controller to adjust the supply amount of the carrier gas.

5. The apparatus of Claim 1, wherein the controller is configured to control the heater to adjust the temperature of the heater based on the temperature of the processing gas detected by the processing gas temperature sensor and control the liquid precursor supply controller to adjust the supply amount of the liquid precursor.

6. The apparatus of Claim 1, wherein, when the temperature of the processing gas detected by the processing gas temperature sensor is lower than a predetermined temperature, the controller is configured to control the heater to increase the temperature of the heater.

7. The apparatus of Claim 4, wherein, when the temperature of the processing gas detected by the processing gas temperature sensor is lower than a predetermined temperature, the controller is configured to control the carrier gas supply controller to increase the supply amount of the carrier gas.

8. The apparatus of Claim 5, wherein, when the temperature of the processing gas detected by the processing gas temperature sensor is lower than a predetermined temperature, the controller is configured to control the liquid precursor supply controller to decrease the supply amount of the liquid precursor.

9. The apparatus of Claim 1, comprising a processing gas pressure sensor configured to detect a pressure of the processing gas in the processing gas supply pipe,
wherein the controller is configured to control the carrier gas supply controller to adjust the supply amount of the carrier gas, based on the pressure of the processing gas detected by the processing gas pressure sensor..

10. The apparatus of Claim 1, comprising a processing gas pressure sensor configured to detect a pressure of the processing gas in the processing gas supply pipe,
wherein the controller is configured to control the liquid precursor supply controller to adjust the supply amount of the liquid precursor, based on the pressure of the processing gas detected by the processing gas pressure sensor.

11. The apparatus of Claim 1, comprising a gas concentration sensor configured to detect a gas concentration of the reaction gas contained in the processing gas delivered from the vaporizer into the processing gas supply pipe,
wherein the controller is configured to control the carrier gas supply controller to adjust the supply amount of the carrier gas, based on the gas concentration of the reaction gas detected by the gas concentration sensor.

12. The apparatus of Claim 1, comprising a gas concentration sensor configured to detect a gas concentration of the reaction gas contained in the processing gas delivered from the vaporizer into the processing gas supply pipe,

wherein the controller is configured to control the liquid precursor supply controller to

adjust the supply amount of the liquid precursor, based on the gas concentration of the reaction gas detected by the gas concentration sensor.

13. The apparatus of Claim 1, wherein the processing gas includes a hydrogen peroxide gas as the reaction gas.

14. A method of manufacturing a semiconductor device, comprising:

processing a substrate using a substrate processing apparatus, the substrate processing apparatus including:

a process chamber configured to accommodate the substrate;

a vaporizer configured to deliver a processing gas containing a reaction gas and a carrier gas, the reaction gas being generated by vaporizing a liquid precursor;

a processing gas supply pipe configured to introduce the processing gas delivered from the vaporizer into the process chamber; and

a processing gas temperature sensor that detects a temperature of the processing gas delivered from the vaporizer into the processing gas supply pipe,

wherein the act of processing the substrate includes:

loading the substrate into the process chamber;

generating the processing gas by supplying the liquid precursor and the carrier gas into the vaporizer and heating the liquid precursor by the heater to vaporize the liquid precursor;

introducing the processing gas generated in the vaporizer into the process chamber through the processing gas supply pipe; and

adjusting a temperature of the heater based on the temperature of the processing gas detected by the processing gas temperature sensor.

15. The method of Claim 14, wherein the substrate processing apparatus includes a processing gas pressure sensor configured to detect a pressure of the processing gas in the

processing gas supply pipe,

wherein the temperature of the heater is adjusted based on the pressure of the processing gas detected by the processing gas pressure sensor and the temperature of the processing gas detected by the processing gas temperature sensor in the act of adjusting the temperature of the heater.

16. The method of Claim 14, wherein the substrate processing apparatus includes a gas concentration sensor configured to detect a gas concentration of the reaction gas contained in the processing gas delivered from the vaporizer into the processing gas supply pipe,

wherein the temperature of the heater is adjusted based on the gas concentration of the reaction gas detected by the gas concentration sensor and the temperature of the processing gas detected by the processing gas temperature sensor in the act of adjusting the temperature of the heater.

17. The method of Claim 14, wherein the temperature of the heater is adjusted and a supply amount of the carrier gas supplied into the vaporizer is adjusted based on the temperature of the processing gas detected by the processing gas temperature sensor in the act of adjusting the temperature of the heater.

18. The method of Claim 14, wherein the temperature of the heater is adjusted and a supply amount of the liquid precursor supplied into the vaporizer is adjusted based on the temperature of the processing gas detected by the processing gas temperature sensor in the act of adjusting the temperature of the heater.

19. A computer-readable recording medium storing a program that causes a computer to perform a predetermined process of processing a substrate by controlling a substrate processing apparatus, the substrate processing apparatus including: a process chamber configured to accommodate a substrate; a vaporizer configured to deliver a processing gas containing a

reaction gas and a carrier gas, the reaction gas being generated by vaporizing a liquid precursor; a processing gas supply pipe configured to introduce the processing gas delivered from the vaporizer into the process chamber; and a processing gas temperature sensor that detects a temperature of the processing gas delivered from the vaporizer into the processing gas supply pipe, and the predetermined process comprising:

- loading the substrate into the process chamber;

- generating the processing gas by supplying the liquid precursor and the carrier gas into the vaporizer and heating the liquid precursor by the heater to vaporize the liquid precursor;

- introducing the processing gas generated in the vaporizer into the process chamber through the processing gas supply pipe; and

- controlling at least one of operations to (a) adjust a temperature of the heater, (b) adjust a supply amount of the carrier gas supplied into the vaporizer and (c) adjust a supply amount of the liquid precursor supplied into the vaporizer based on the temperature of the processing gas detected by the processing gas temperature sensor.