

METHOD OF MANUFACTURING SEMICONDUCTOR DEVICE, METHOD OF PROCESSING SUBSTRATE, SUBSTRATE PROCESSING APPARATUS, AND PROGRAM

TECHNICAL FIELD

[0001] The present disclosure relates to a method of manufacturing a semiconductor device, a method of processing a substrate, a substrate processing apparatus, and a program.

BACKGROUND

[0002] As a process of manufacturing a semiconductor device, a step of supplying a process gas to an interior of a process container that accommodates a substrate to process the substrate and a step of supplying a cleaning gas to the interior of the process container that does not accommodate the substrate to clean the interior of the process container may be often repeatedly carried out.

[Prior Art Documents]

[0003] Patent Documents

Patent Document 1: Japanese Patent Application Laid-open No. 2002-222805

SUMMARY

[0004] Some embodiments of the present disclosure provide a technique capable of improving the characteristics of a film formed on a substrate.

[0005] According to one embodiment of the present disclosure, there is provided a technique that includes performing a cycle a predetermined number of times, the cycle including: (a) executing a process recipe of processing a substrate by supplying a process gas to an interior of a process container that accommodates the substrate in a state in which the interior of the process container is heated; and (b) executing a cleaning recipe of cleaning the interior of the process container by supplying a cleaning gas to the interior of the process container that does not accommodate the substrate in the state in which the interior of the process container is heated, wherein a time from an end of (b) in the cycle until a start of (a) in a next cycle is set to be equal

WHAT IS CLAIMED IS:

1. A method of manufacturing a semiconductor device, comprising:
performing a cycle a predetermined number of times, the cycle including:
 - (a) executing a process recipe of processing the substrate by supplying a process gas to an interior of a process container that accommodates the substrate in a state in which the interior of the process container is heated; and
 - (b) executing a cleaning recipe of cleaning the interior of the process container by supplying a cleaning gas to the interior of the process container that does not accommodate the substrate in the state in which the interior of the process container is heated,wherein a time from an end of (b) in the cycle until a start of (a) in a next cycle is set to be equal to or less than a time from an end of (a) in the cycle until a start of (b) in the cycle.
2. The method of Claim 1, further comprising:
 - (c) maintaining the state in which the interior of the process container is heated, without supplying the process gas and the cleaning gas to the interior of the process container that does not accommodate the substrate in the state in which the interior of the process container is heated,wherein (c) is not performed in the time from the end of (b) in the cycle until the start of (a) in the next cycle.
3. The method of Claim 2, wherein (c) is performed in the time from the end of (a) in the cycle until the start of (b) in the cycle.

4. The method of Claim 2, wherein (c) is not performed in the time from the end of (a) in the cycle until the start of (b) in the cycle.
5. The method of any of Claims 1 to 4, wherein (a) is started immediately after the end of (b).
6. The method of Claim 5, wherein (b) is started with a lapse of a predetermined time after the end of (a).
7. The method of Claim 5, wherein (b) is started immediately after the end of (a).
8. The method of any of Claims 1 to 7, wherein the time from the end of (b) in the cycle until the start of (a) in the next cycle is set to 0 hour.
9. The method of Claim 8, wherein the time from the end of (a) in the cycle until the start of (b) in the cycle is set to 0 hour.
10. The method of any of Claims 1 to 9, wherein a maximum temperature of the interior of the process container in (a) is different from the maximum temperature of the interior of the process container in (b).
11. The method of Claim 10, wherein the maximum temperature of the interior of the process container in (b) is higher than the maximum temperature of the interior of the process container in (a).

12. The method of Claim 10 or 11, wherein (b) includes:
- (b1) supplying the cleaning gas to the interior of the process container that is set to a first temperature;
- (b2) raising a temperature of the interior of the process container from the first temperature to a second temperature; and
- (b3) lowering the temperature of the interior of the process container from the second temperature to a processing temperature in (a).
13. The method of Claim 12, wherein the first temperature is lower than the processing temperature in (a), and the second temperature is higher than the processing temperature in (a).
14. The method of Claim 12 or 13, wherein in (b2), an inert gas is supplied into the process container and is exhausted from the process container.
15. The method of any of Claims 1 to 14, wherein the cleaning gas is a halogen-containing gas.
16. The method of any of Claims 1 to 15, wherein (a) includes forming a film on the substrate.
17. The method of any of Claims 1 to 16, wherein the cycle includes alternately and repeatedly performing (a) once and performing (b) once.
18. The method of any of Claims 1 to 16, wherein the cycle includes alternately and repeatedly performing (a) multiple times and performing (b) once.

19. A method of processing a substrate, comprising:
- performing a cycle a predetermined number of times, the cycle including:
- (a) executing a process recipe of processing the substrate by supplying a process gas to an interior of a process container that accommodates the substrate in a state in which the interior of the process container is heated; and
 - (b) executing a cleaning recipe of cleaning the interior of the process container by supplying a cleaning gas to the interior of the process container that does not accommodate the substrate in the state in which the interior of the process container is heated,
- wherein a time from an end of (b) in the cycle until a start of (a) in a next cycle is set to be equal to or less than a time from an end of (a) in the cycle until a start of (b) in the cycle.
20. A substrate processing apparatus comprising:
- a process container in which a substrate is processed;
 - a heater configured to heat an interior of the process container;
 - a process gas supply system configured to supply a process gas to the interior of the process container;
 - a cleaning gas supply system configured to supply a cleaning gas to the interior of the process container; and
 - a controller configured to be capable of controlling the heater, the process gas supply system, and the cleaning gas supply system so as to perform a process including: performing a cycle a predetermined number of times, the cycle including: (a) executing a process recipe of processing the substrate by supplying the process gas to the interior of the process container that accommodates the substrate in a state in which the interior of the process container is heated; and (b) executing a cleaning recipe of cleaning the interior of the process container by supplying the

cleaning gas to the interior of the process container that does not accommodate the substrate in the state in which the interior of the process container is heated, wherein a time from an end of (b) in the cycle until a start of (a) in a next cycle is set to be equal to or less than a time from an end of (a) in the cycle until a start (b) in the cycle.

21. A program that causes, by a computer, a substrate processing apparatus to perform a process comprising:

performing a cycle a predetermined number of times, the cycle including:

(a) executing a process recipe of processing a substrate by supplying a process gas to an interior of a process container that accommodates the substrate in a state in which the interior of the process container is heated; and

(b) executing a cleaning recipe of cleaning the interior of the process container by supplying a cleaning gas to the interior of the process container that does not accommodate the substrate in the state in which the interior of the process container is heated,

wherein a time from an end of (b) in the cycle until a start of (a) in a next cycle is set to be equal to or less than a time from an end of (a) in the cycle until a start of (b) in the cycle.