FIG. 1

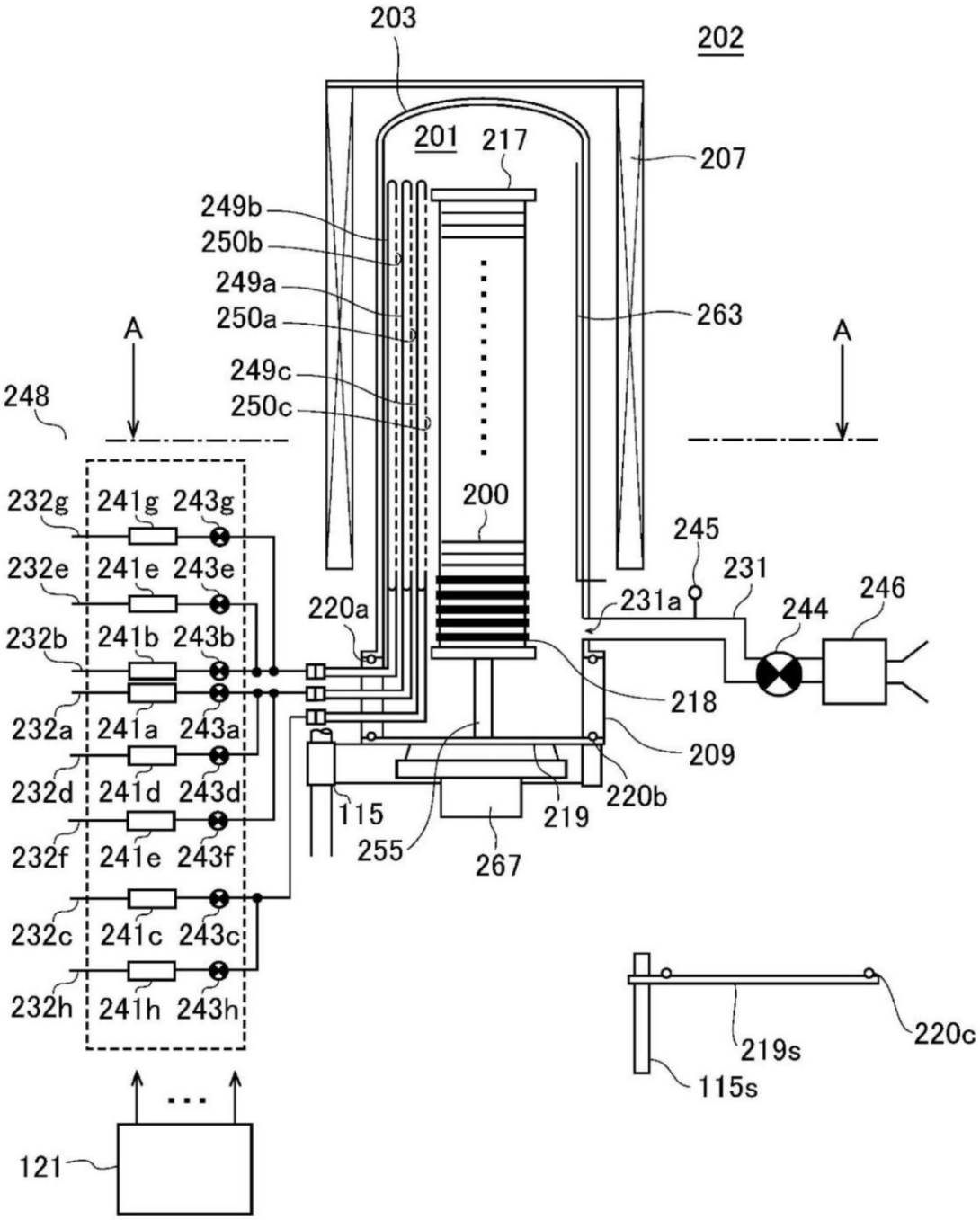

203
202
201
217
207
249b
250b
249a
250a
263
A
A
249c
250c
248
200
245
231
246
244
231a
220a
218
209
220b
219
115
255
267
232g
241g
243g
232e
241e
243e
232b
241b
243b
232a
241a
243a
232d
241d
243d
232f
241e
243f
232c
241c
243c
232h
241h
243h
121
219s
220c
115s

FIG. 2

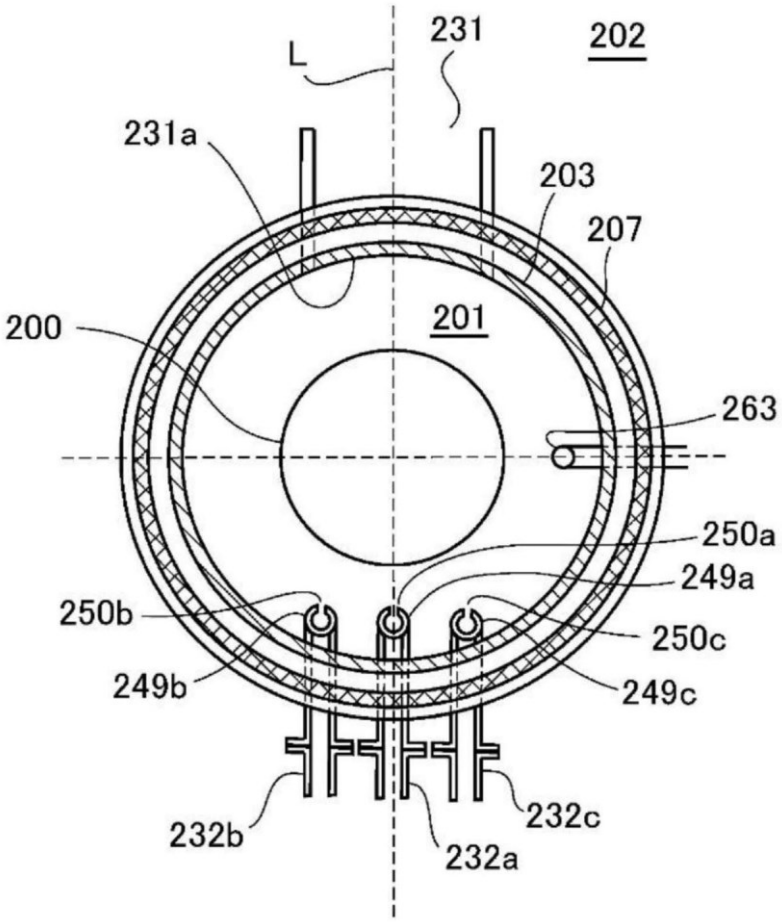

L
231
202
231a
203
207
200
201
263
250a
249a
250b
250c
249b
249c
232b
232c
232a

FIG. 3

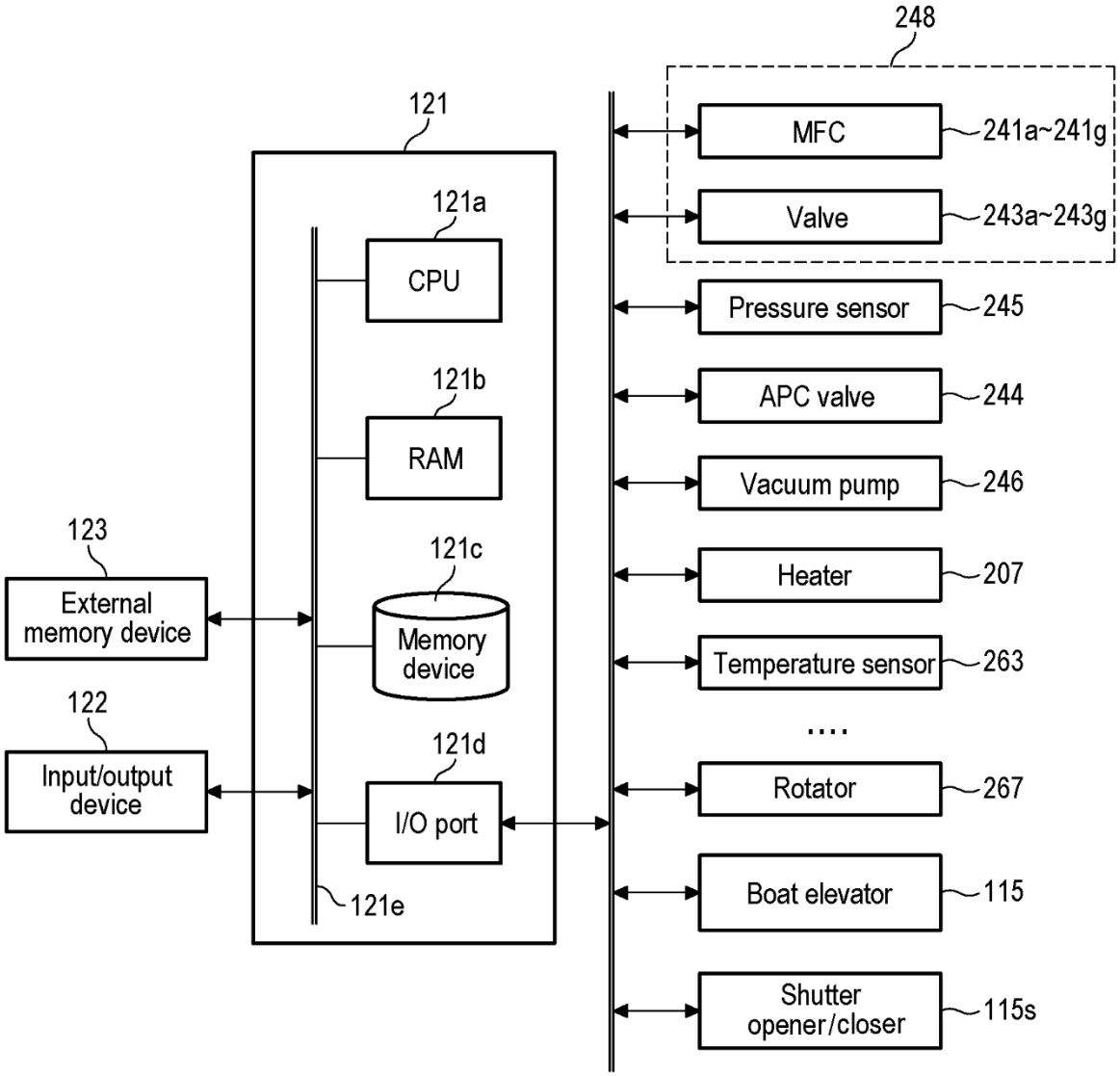

248
121
121a
CPU
121b
RAM
121c
Memory device
121d
I/O port
121e
123
External memory device
122
Input/output device
MFC
241a~241g
Valve
243a~243g
Pressure sensor
245
APC valve
244
Vacuum pump
246
Heater
207
Temperature sensor
263
....
Rotator
267
Boat elevator
115
Shutter opener/closer
115s

FIG. 4

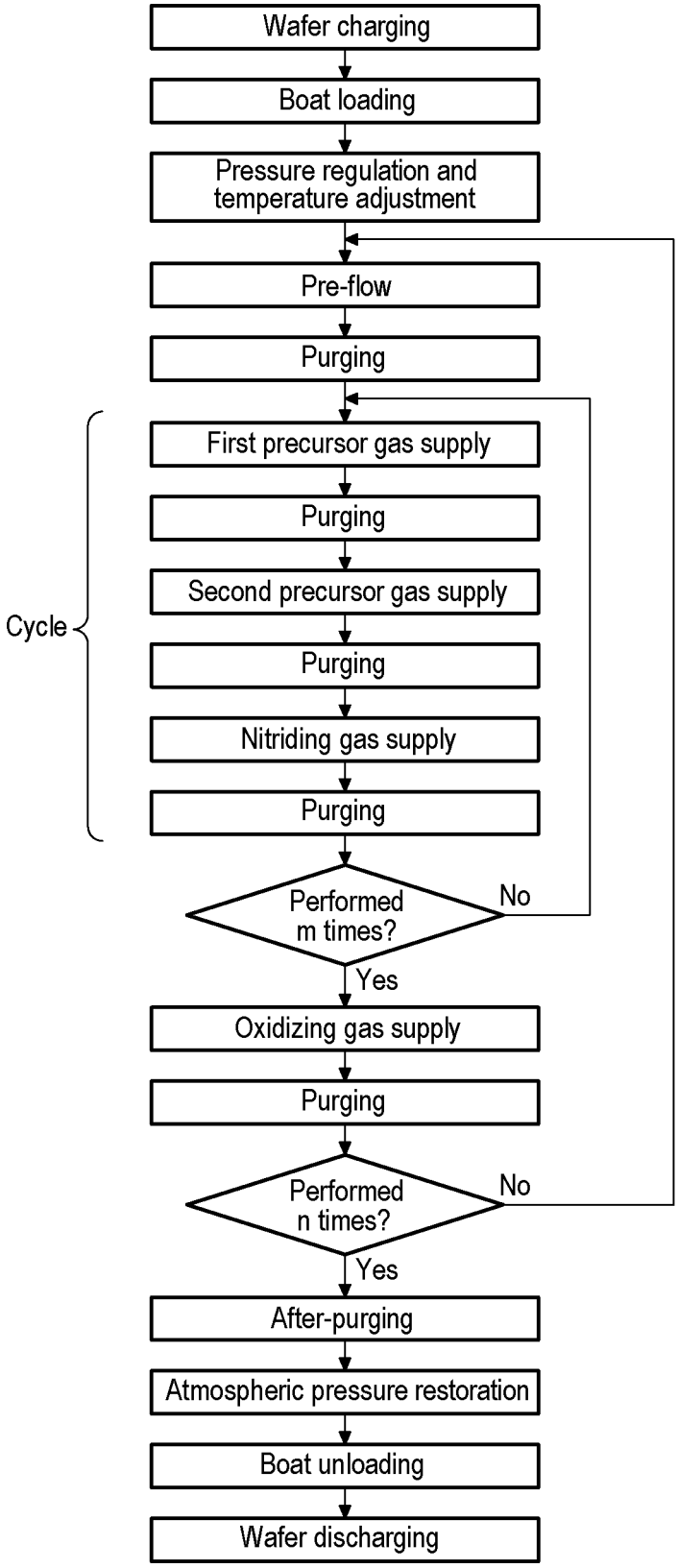

Wafer charging
Boat loading
Pressure regulation and temperature adjustment
Pre-flow
Purging
First precursor gas supply
Purging
Second precursor gas supply
Purging
Nitriding gas supply
Purging
Cycle
Performed m times?
No
Yes
Oxidizing gas supply
Purging
Performed n times?
No
Yes
After-purging
Atmospheric pressure restoration
Boat unloading
Wafer discharging

FIG. 5A

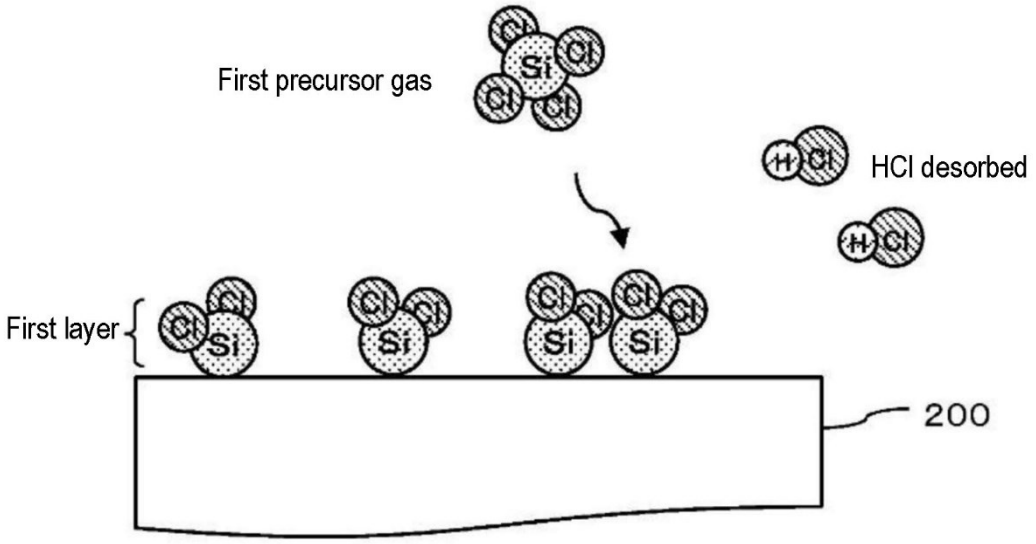

First precursor gas
HCl desorbed
First layer
200

FIG. 5B

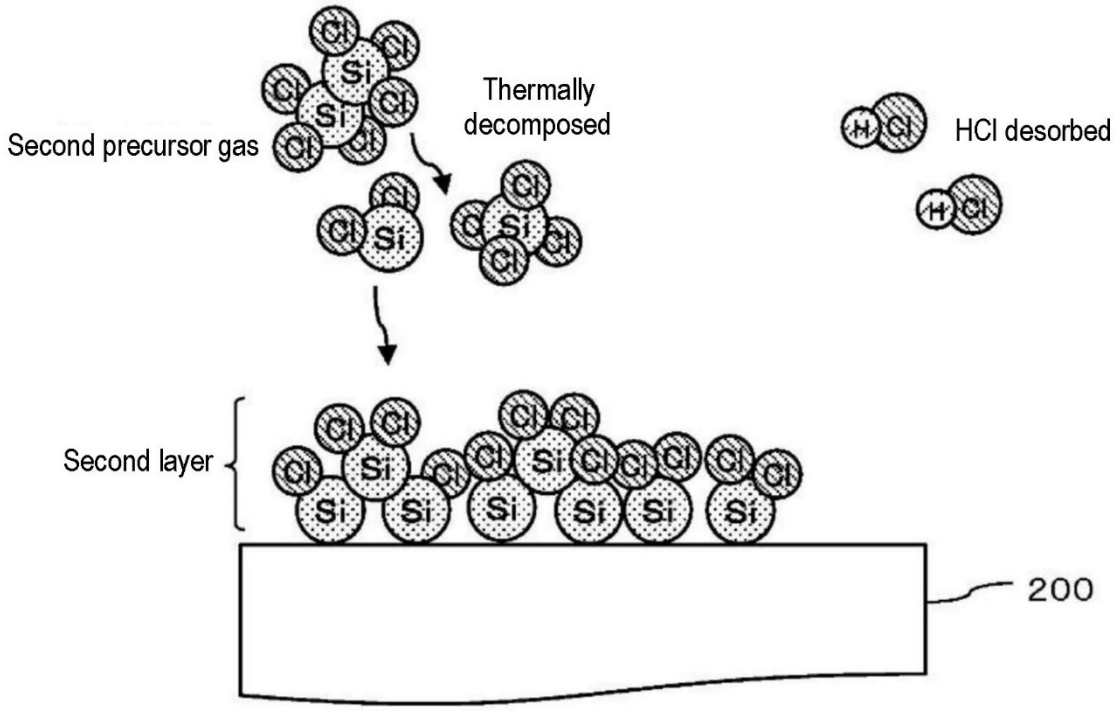

Second precursor gas
Thermally decomposed
HCl desorbed
Second layer
200

FIG. 5C

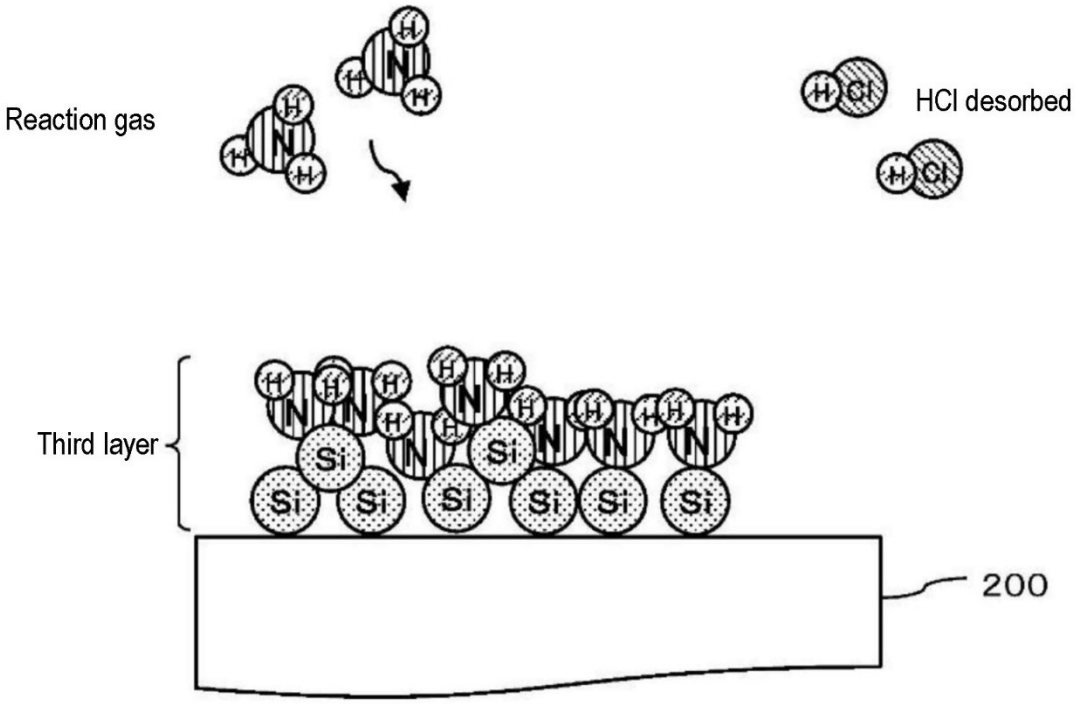

Reaction gas
HCl desorbed
Third layer
200

FIG. 6

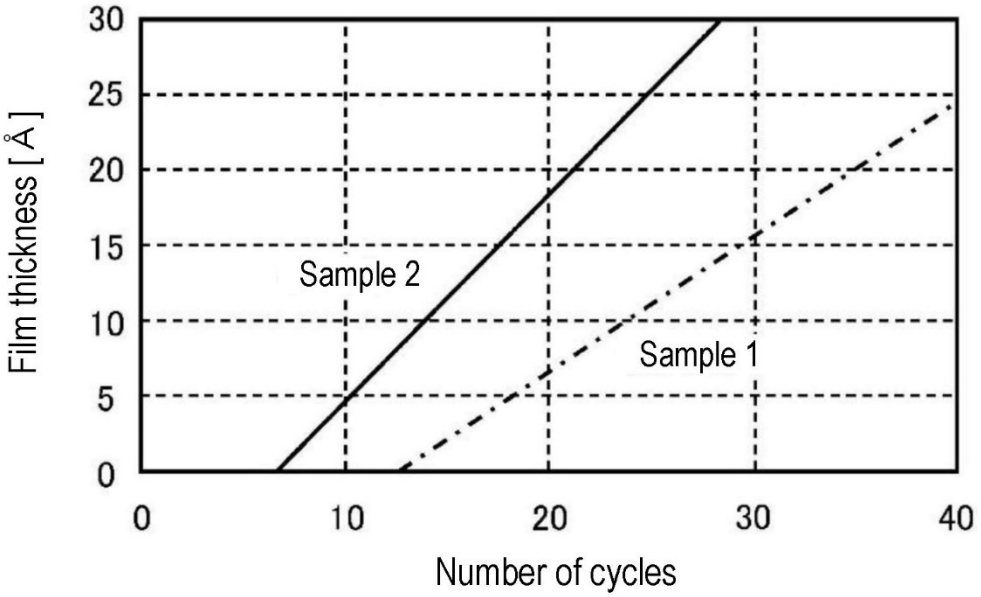

Film thickness [Å]
30
25
20
15
10
5
0
Sample 2
Sample 1
0
10
20
30
40
Number of cycles

FIG. 7

	Sample 3	Sample 4
First precursor gas supply time (sec)	—	60
Second precursor gas supply time (sec)	9	9
Top/bottom ratio (%)	88	95

FIG. 8

