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Temperature dependence of ALD SiO₂ growth

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Keywords

Atomic Layer Deposition SiO₂

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Temperature Dependence of ALD SiO₂ growth (Graduate Student Fellow Program)

Prepared by Zisong Nie (11/26/2014)

1. SiO₂

SiO₂ grown with Tris(dimethylamino)silane (TDMASi or TDMAS) and O₃

- Film thickness is measured by VAS ellipsometer.
- The native oxide thickness is about 1.5nm.
- 100 cycle deposition.

Default recipes

	Instruction	#	80-120 C	150-200 C	250 C	300-350	
0	flow		20	20	20	20	Set precursor manifold stand-by N2 flow rate
1	heater	9	Temp	Temp	Temp	Temp	Set Inner reactor temperature
2	heater	8	Temp	Temp	Temp	Temp	Set Outer reactor temperature
3	stabilize	9					Wait for Inner reactor temperature to stabilize
4	stabilize	8					Wait for Outer reactor temperature to stabilize
5	wait		600	600	600	600	Wait for substrate temperature to stabilize
6	line ac out	4	1	1	1	1	Turn on O3 generator ON
7	wait		120	120	120	120	Purge O3 line through ozone destruct bypass
8	pulse	4	0.2	0.2	0.2	0.2	Prime O3 line to reactor
9	wait		10	10	10	10	
10	goto	8	6	6	6	6	Repeat 6 times
11	flow		0	0	0	0	Set N2 flow to zero prior to expo mode
12	wait		3	3	3	3	
13	stopvalve		0	0	0	0	Close stop valve for expo mode
14	wait		0.5	0.5	0.5	0.5	wait 0.5 sec fro stop valve to close
15	pulse	2	0.05	0.05	0.05	0.05	Pulse TDMAS.
16	wait		40	28	28	28	TDMAS expo time
17	stopvalve		1	1	1	1	Open stop valve to pump down chamber
18	flow		100	100	100	100	Set purge flow to 100 sccm
19	wait		13	13	13	10	TDMAS purge time
20	flow		0	0	0	0	Set N2 flow to zero
21	wait		3	3	3	3	
22	stopvalve		0	0	0	0	Close stop valve for expo mode
23	wait		0.5	0.5	0.5	0.5	
24	pulse	4	0.2	0.2	0.2	0.2	Pulse ozone
25	wait		30	15	7	7	Ozone expo time
26	stopvalve		1	1	1	1	Open stop valve to pump down chamber
27	flow		100	100	100	100	Set purge flow to 100 sccm
28	wait		13	13	13	13	Purge ozone and reaction by-products
29	goto	11	x	x	x	x	x = cycles
30	line ac out	4	0	0	0	0	Turn off O3 generator ON

sample #	Temperature (°C)	Film thickness (nm)	deposition rate (Å/cycle)	Default deposition rate (Å/cycle)
1	150	4.84	0.48	0.9
2	200	8.38	0.84	1.1
3	250	10.4	1.04	1.1

* The native oxide thickness (1.5 nm) is subtracted from the thickness measured.

Temperature dependence of SiO₂ growth rate

