

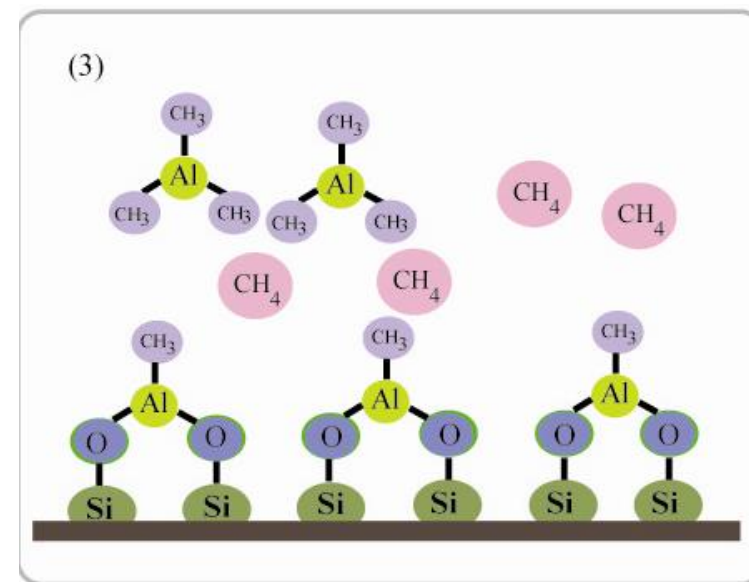
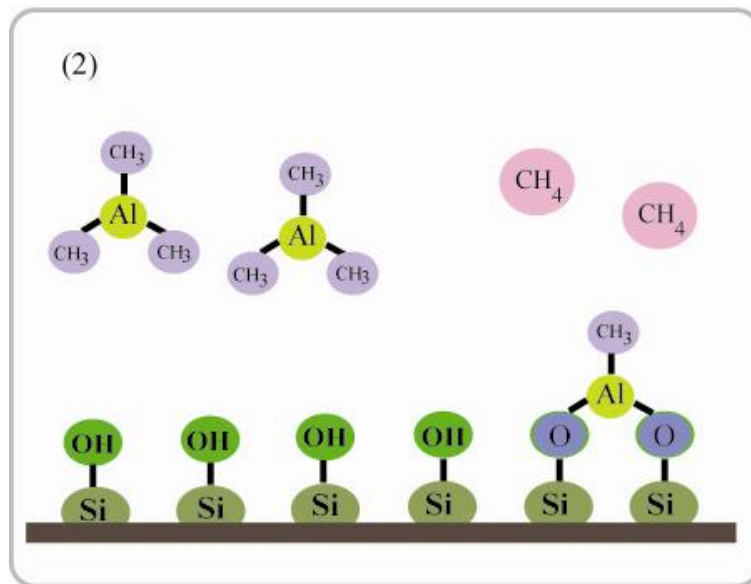
Atomic Layer Deposition Overview



Theory

Atomic Layer Deposition (ALD) is a technique that allows growth of thin films, atomic layer by layer. The typical ALD reaction is illustrated via the formation of Al_2O_3 from trimethylaluminum TMA and water.

Step 1: Introduction and adsorption of precursor 1 to the surface.



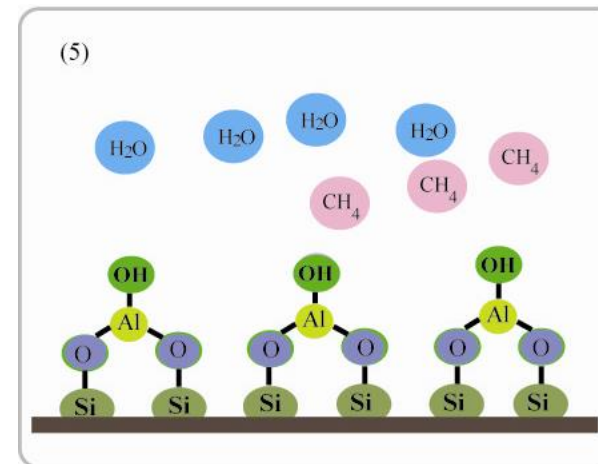
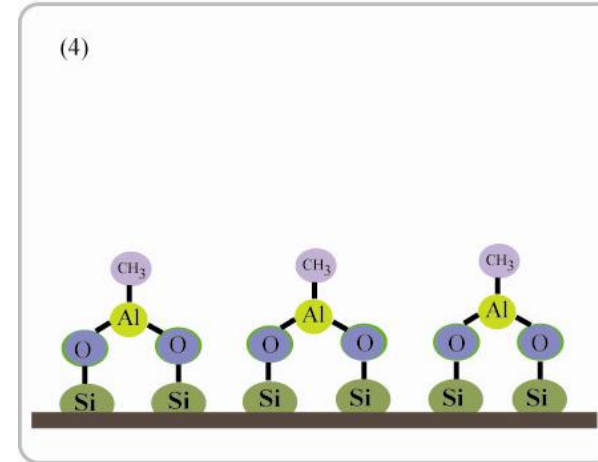
Theory

Step 2: Removal of the unreacted precursor and reaction products.

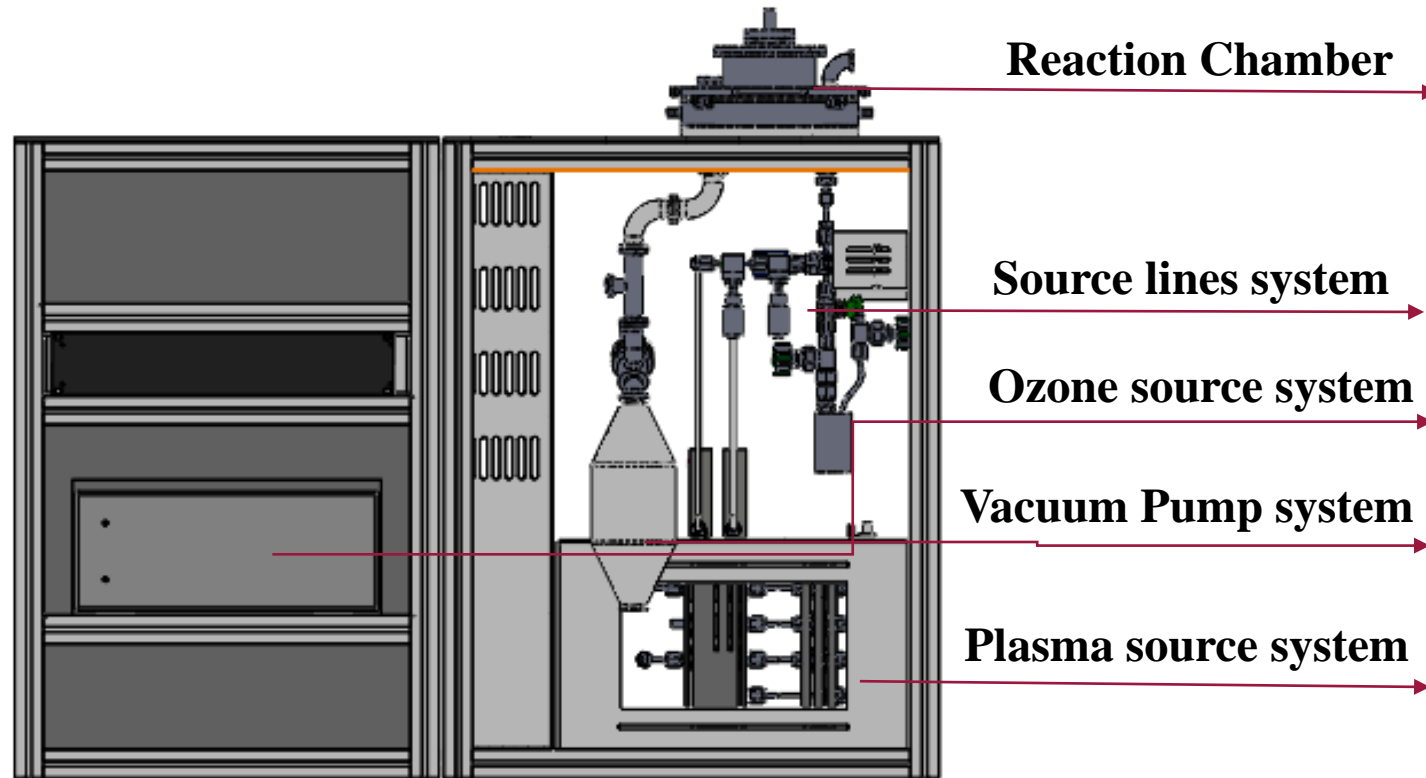
Step 3: Introduction and adsorption of precursor 2 to the surface.

Step 4: Removal of the unreacted precursor and reaction products via evacuation and/or inert gas flow.

Step 5: Repeat to create layers



Hardware Overview



Reaction Chamber

1-1: Chamber lid

1-2: Shower of plasma

1-3: Plasma gas inlet

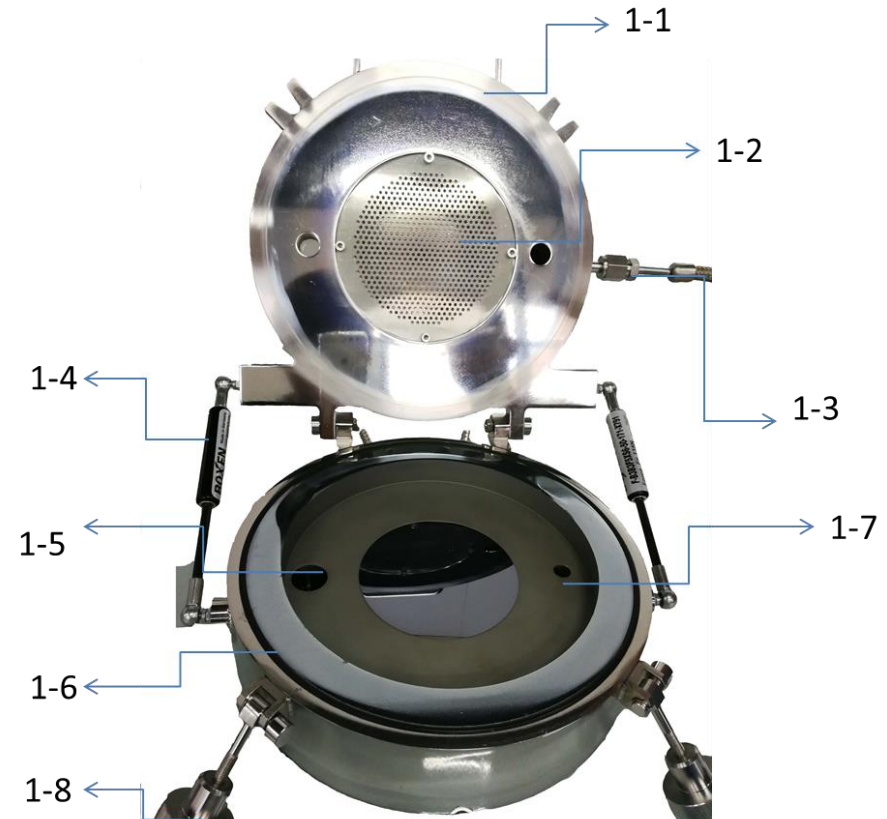
1-4: Gas Spring

1-5: Exhaust outlet, $\text{\O}25$ mm

1-6: O-ring, Viton, ID= 228.19mm, C/S= 3.53
mm

1-7: Precursor inlet, $\text{\O}12$ mm

1-8: Handle



Source lines system

2-1: Outlet of source lines (Line 1)

2-2: Liquid precursor ALD valve (DV-PL1~5)

2-3: Liquid precursor manual valve

2-4: Liquid precursor cylinder (50 ml;
CL1~CL5)

2-5: Mass Flow Controller (MFC2,N₂): 0-100 sccm

2-6: Mass Flow Controller (MFC1,Ar): 0-500 sccm

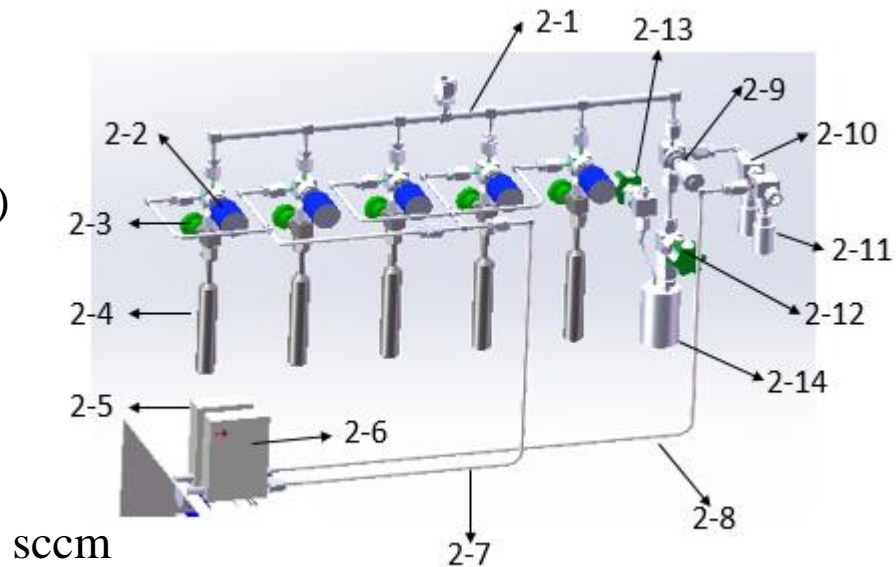
2-7: Carrier gas line

2-8: Carrier gas line

2-9: ALD valve (DV-PS1)

2-10: ALD valve (DV-PS2)

2-11: ALD valve (DV-BS1)



2-12: Manual valve (gas outlet)

2-13: Manual valve (gas inlet)

2-14: Precursor cylinder (100 ml; CS1)

Plasma source system

3-1: ALD valve (DV-PQ1, O₂)

3-2: ALD valve (DV-PQ2, O₃)

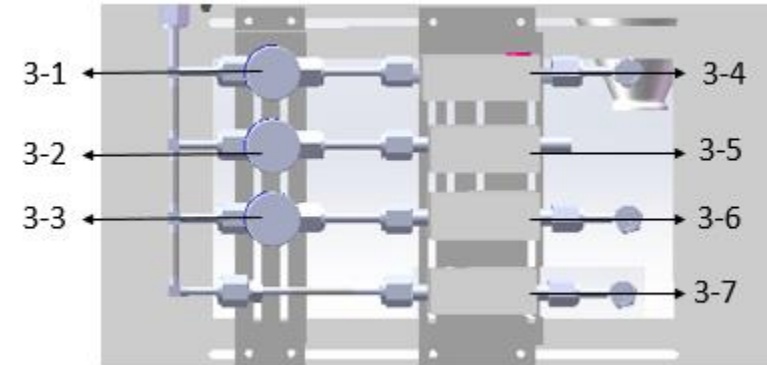
3-3: ALD valve (DV-PQ3,)

3-4: Mass Flow Controller (MFC3,O₂): 0-500 sccm

3-5: Mass Flow Controller (MFC4,O₃): 0-500 sccm

3-6: Mass Flow Controller (MFC5,H₂): 0-500 sccm

3-7: Mass Flow Controller (MFC6,Ar): 0-500 sccm



Vacuum Pump system

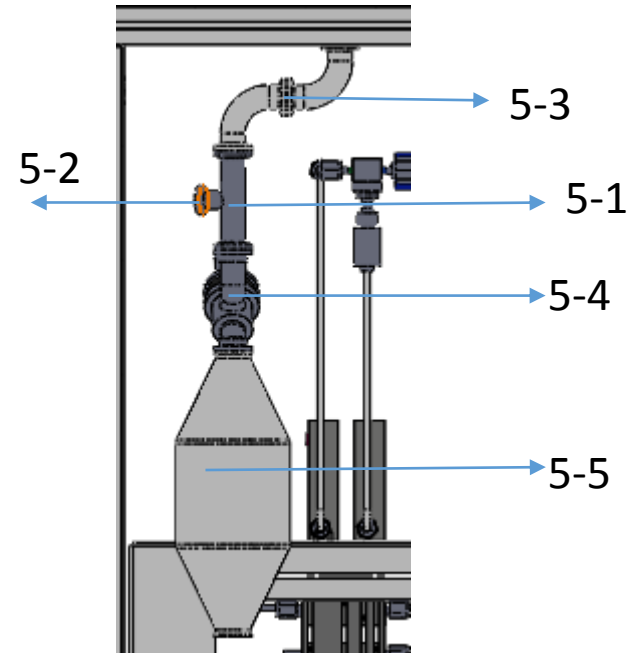
5-1: Tee, KF25-KF16

5-2: Vacuum gauge: 1000- 2.3×10^{-4} Torr

5-3: Clamp, KF25

5-4: Vacuum valve : RT -150 °C (VV1)

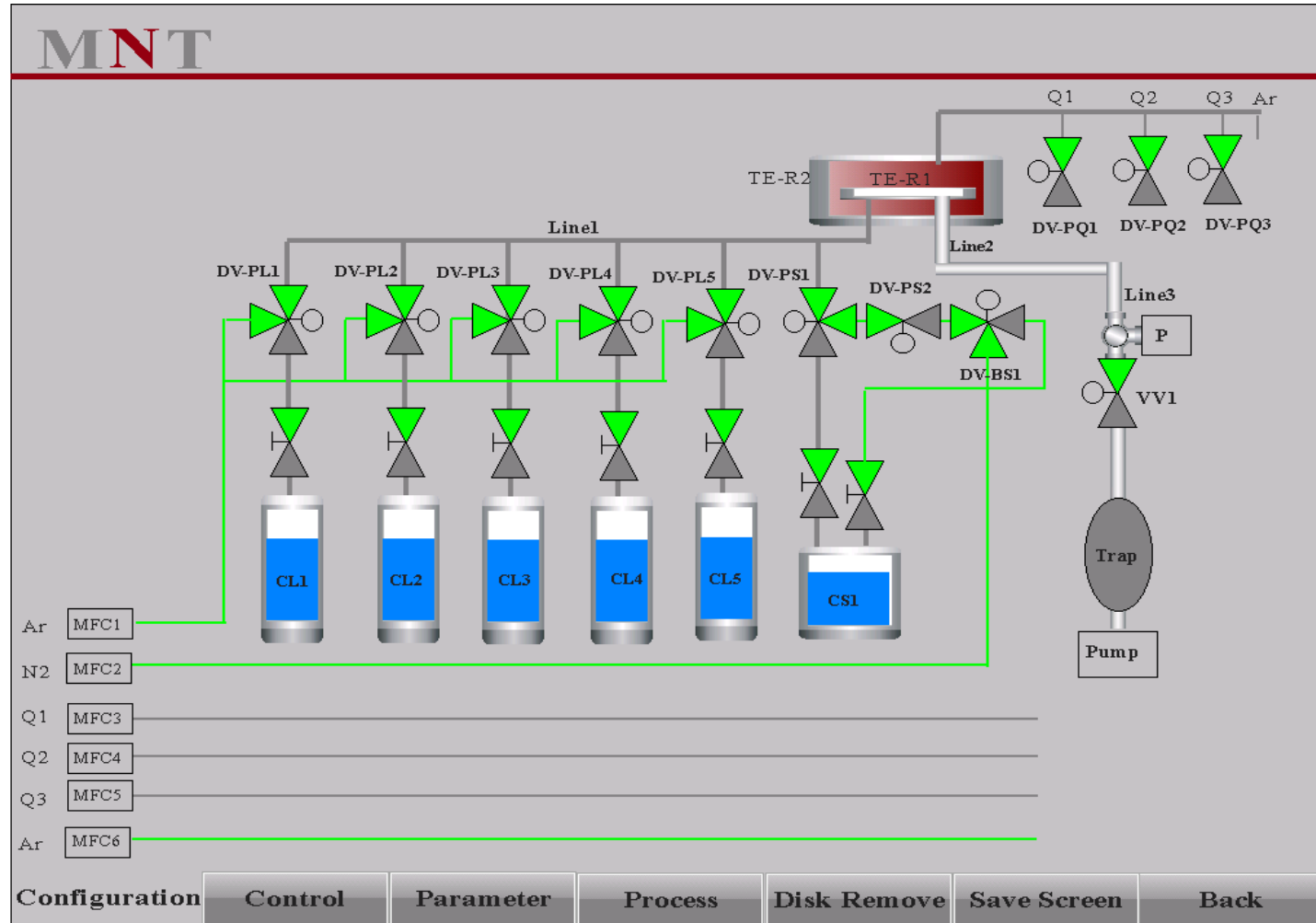
5-5: Trap



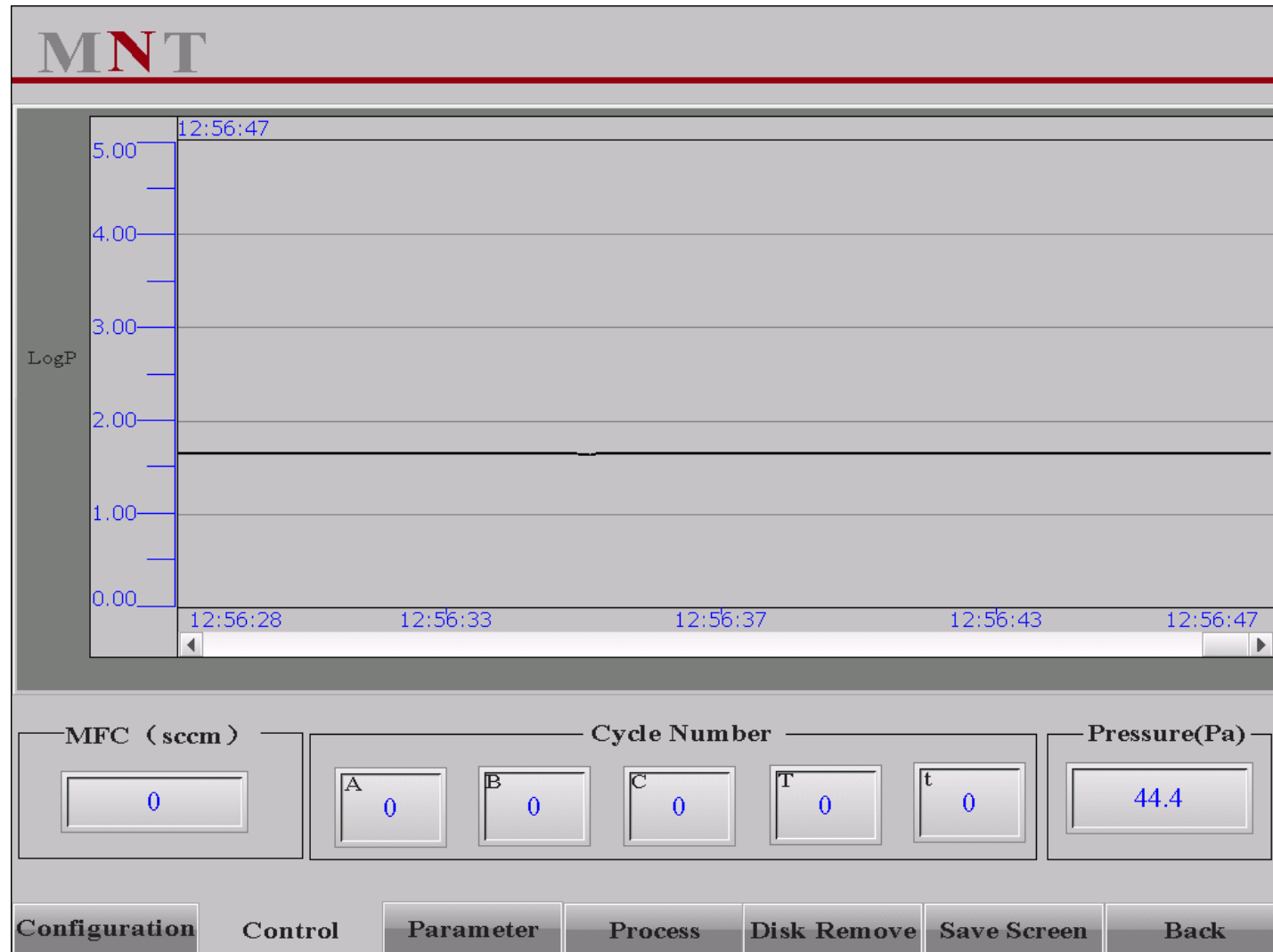
Ozone source system



HMI Overview



HMI Overview



HMI Overview

MNT

MFC(sccm)			Temperature(°C)					
MFC1-Ar			Chamber					
0	0	OK	TE-R1	20	39	UP	Down	
MFC2-N2			Valve					
0	0	OK	TE-PL1	20	31	TE-R2	20	38
MFC3-Q1-O2			TE-PL3	20	32	TE-PL2	20	31
0	0	OK	TE-PL5	20	31	TE-PL4	20	31
MFC4-Q2-O3			TE-VV1	20	32	TE-PS1	20	29
0	0	OK	Precursor Container					
MFC5-Q3-H2			TE-CL1	0	26	TE-CL2	0	26
0	0	OK	TE-CL3	0	26	TE-CL4	0	27
MFC6-Ar			TE-CL5	0	27	TE-CS1	0	26
0	0	OK	Line					
Plasma			TE-L1	20	32	TE-L2	20	32
0		OK	TE-L3	20	30	TE-Trap	20	51

Configuration Control Parameter Process Disk Remove Save Screen Back

