



Use of BTBAS as Silicon Nitride

BTBAS Nitride

1. Purpose of BTBAS

There are some undesired side effects associated with traditional DCS/ NH_3 Nitride. Thermal budget is significantly impacted by the required high temperature of 760-780. The NH_4Cl byproduct clogs stainless steel exhaust components, sheds particles, and the chlorine component causes corrosion,

These problems are eliminated by the use of BTBAS instead of DCS. The new organic precursor(BTBAS) provided by Schumacher, reacts at much lower temperatures than DCS and contains no NH_4Cl byproduct.

BTBAS Nitride

Film Target

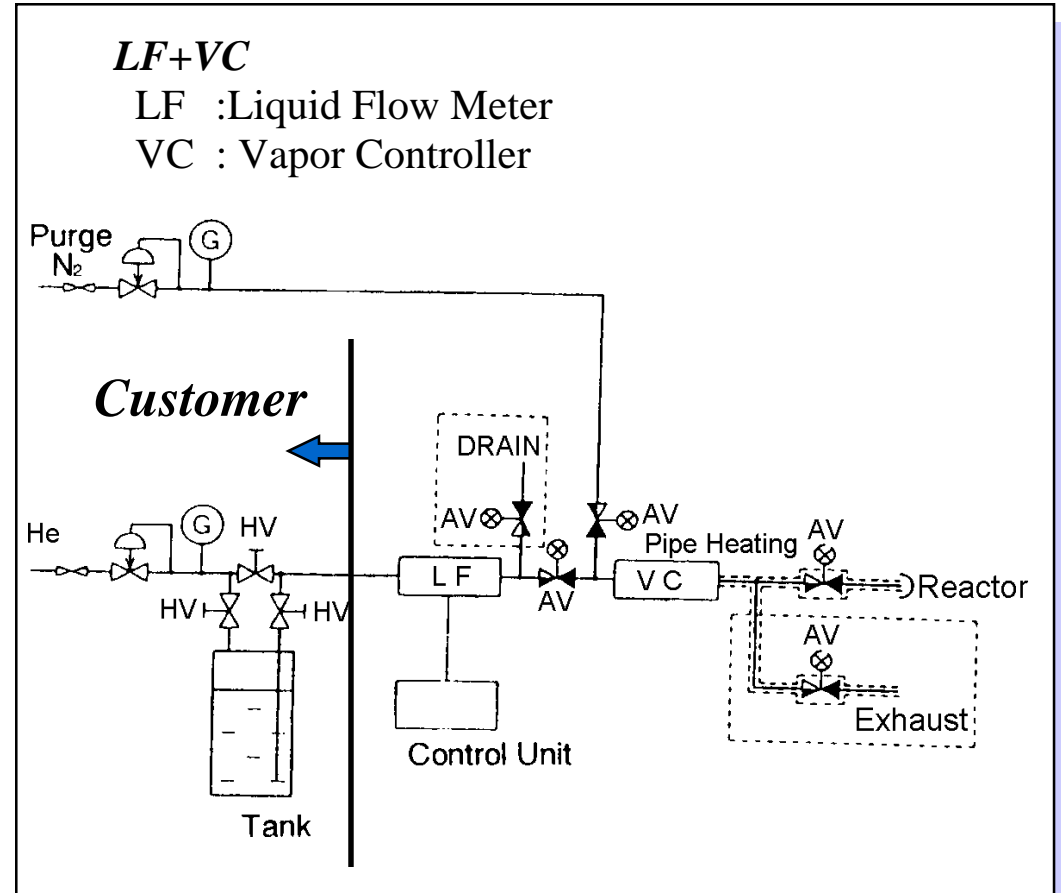
Deposition Result

Film Type	Thickness	Condition	Process Goal					Process Result				
			Uniformity (+-%)			Depo Rate (A/min)	Particle (>0.2)	Uniformity(+-%)			Depo Rate (A/min)	Particles (>0.2)
			WIW	WTW	BTB			WIW	WTW	BTB		
BTBAS/NH ₃ (Si ₃ N ₄)	950	585°C 65Pa 0.55ml/400	3.0	2.0	2.0	>5	<50	2.5	2.0	2.0	4-5	50

BTBAS delivery system

Note

- He press ; 28psi
- VC Temp ; 120C
- Reactor pipe Heater ; 120C
- Exhaust pipe Heater ; 80C
- BTBAS Refill Tank

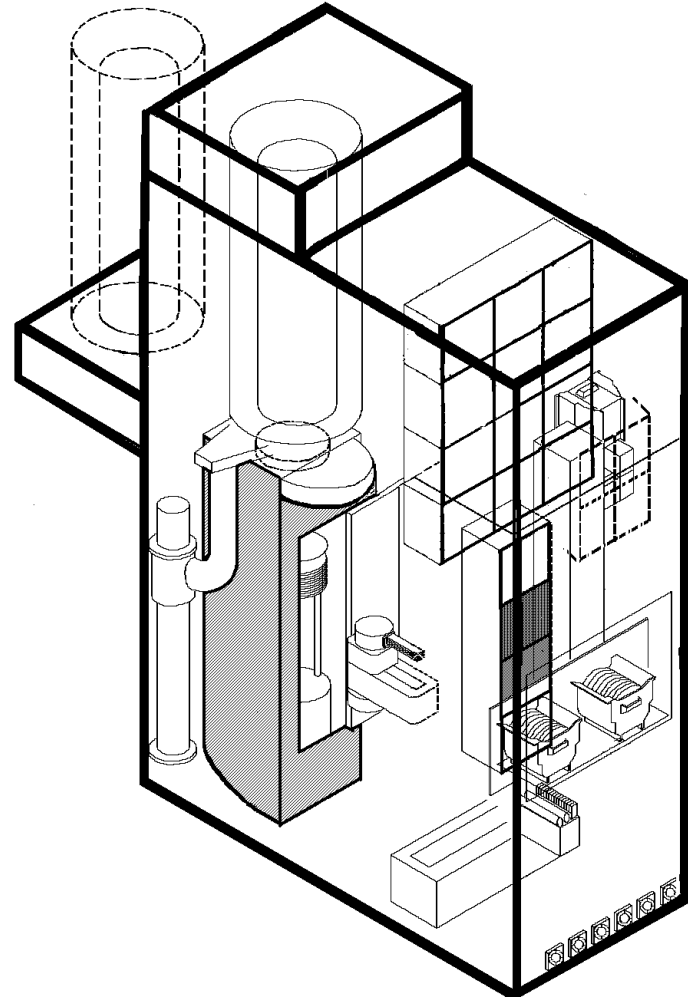


BTBAS Nitride

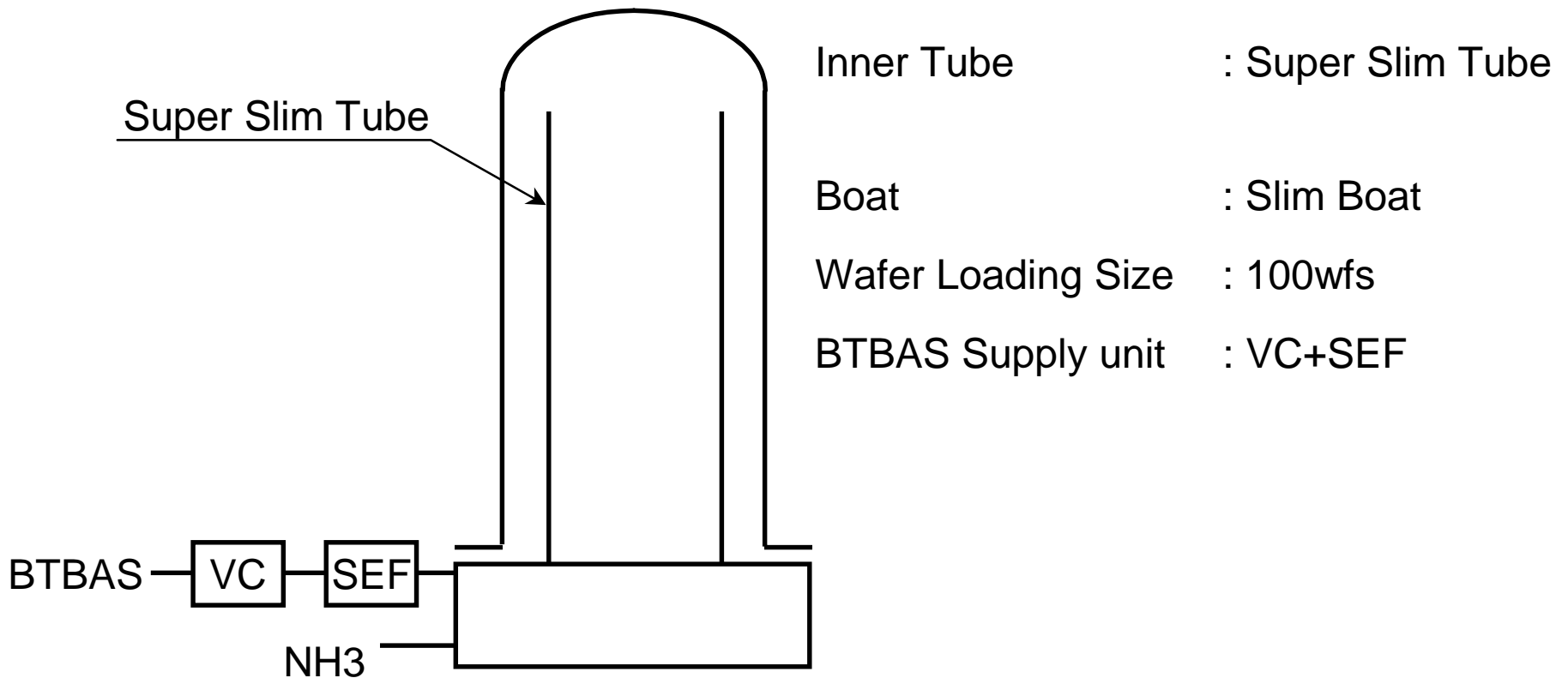
2. Vertical Furnace Configuration

	Item	note
Quartz ware	Outer tube	Standard
	Inner tube	Super Slim Tube
	Boat	Super Slim design
	Short straight Nozzle (NH ₃)	No injection for BTBAS
	Baffle plate	Standard
Gas delivery system	VC-LF	Vaporizer – Liquid Flow Meter

BTBAS Nitride Furnace



BTBAS Nitride Furnace Configuration



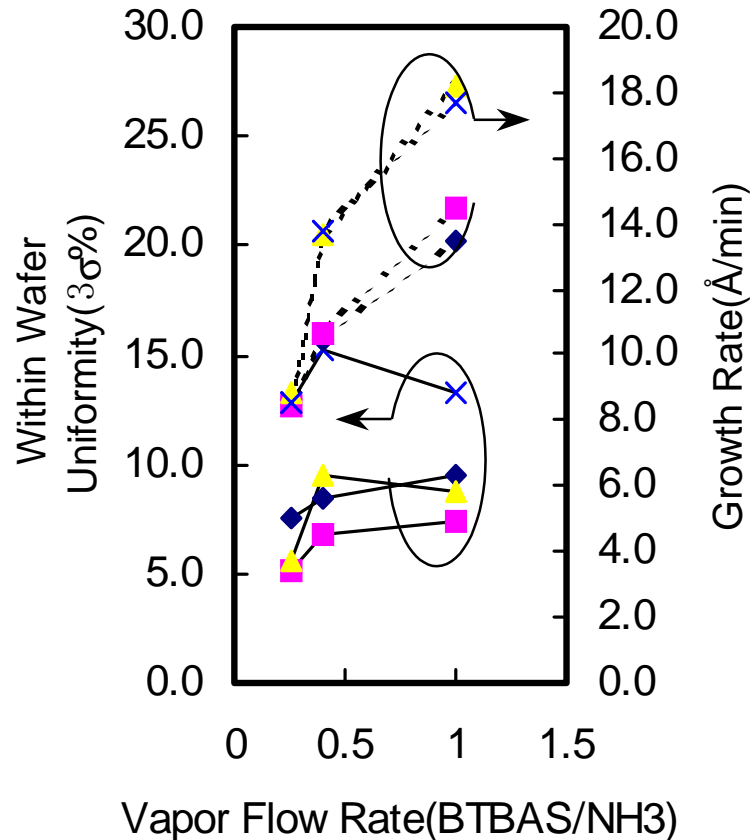
Process Condition

BTBAS Depo

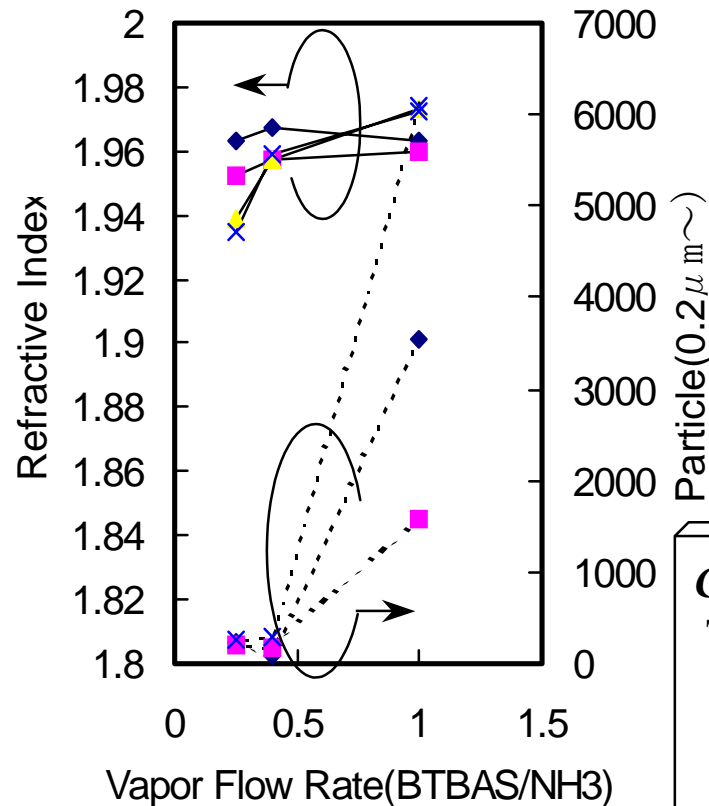
Temp.	: 585 C
BTBAS	: 0.55ml
NH3	: 400cc
Press.	: 65pa
Depo Time	: 2h 45min
Target	: 950 E

Uniformity Dependence on Vapor Flow Rate

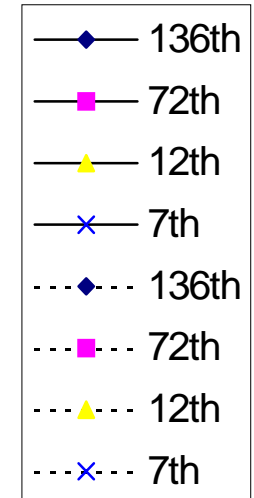
Within Wafer Uniformity and Growth Rate



Refractive Index and Particles



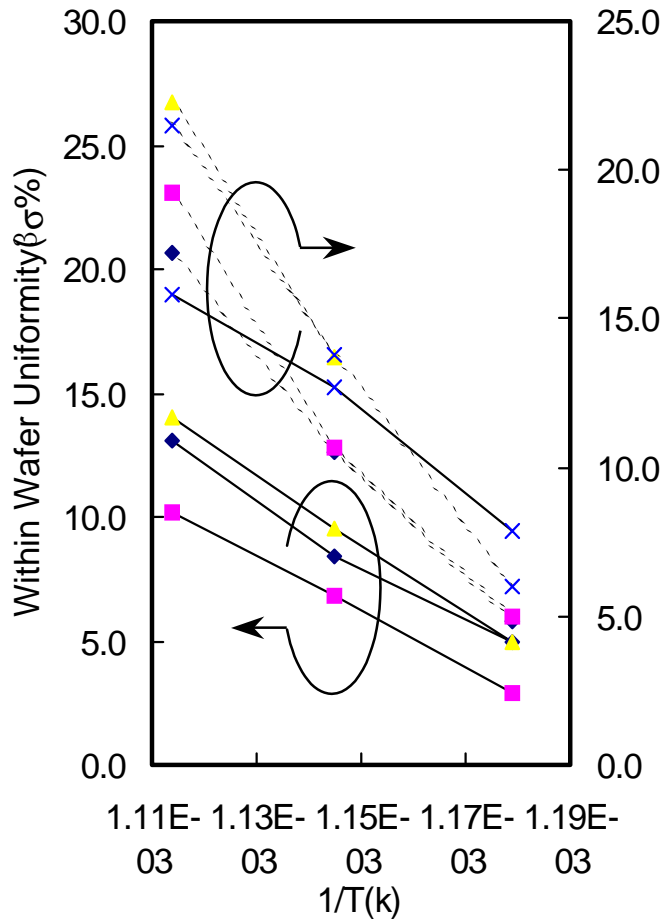
Super Slim Tube



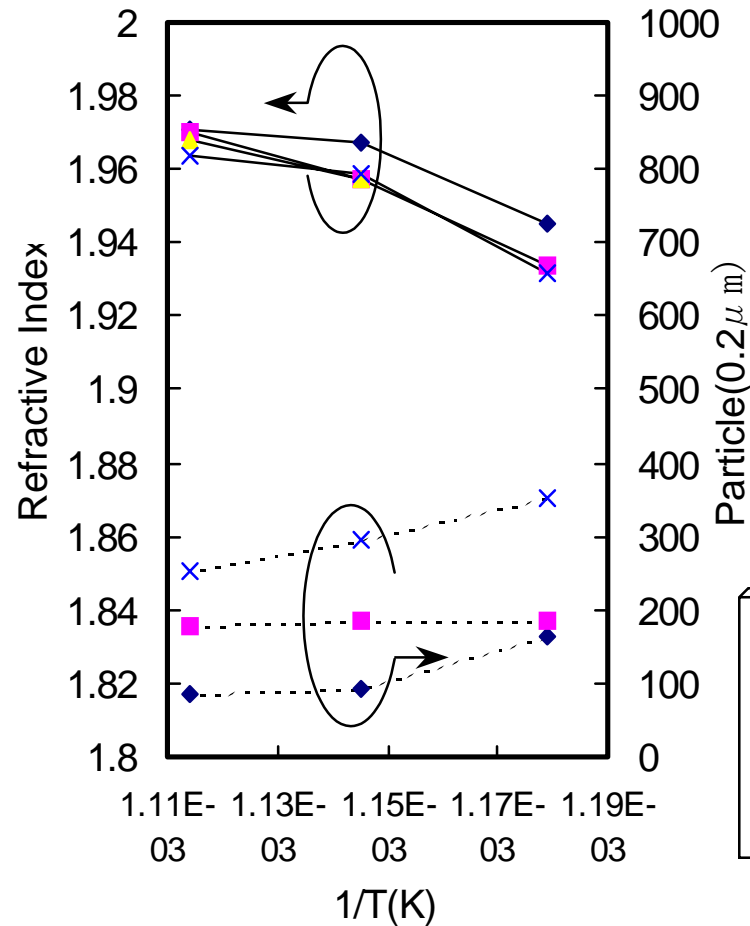
Growth Conditions
 Temp.(°C):U;615
 :CU;600
 :CL;589
 :L;583
 Pressure :30Pa
 Gas:BTBAS80sccm

Uniformity Dependence on Temperature

Within Wafer Uniformity and Growth Rate



Refractive Index and Particles



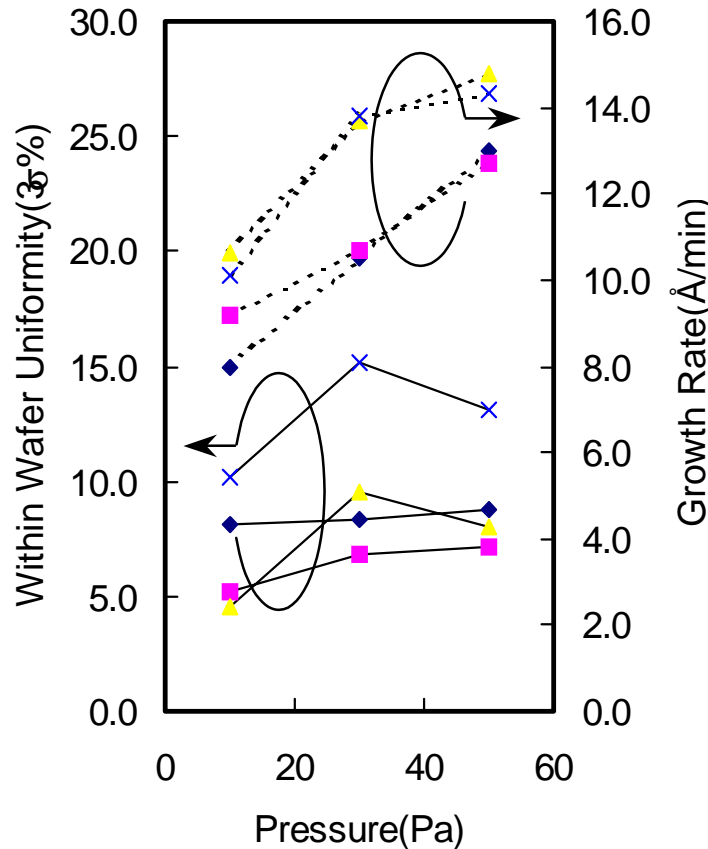
Super Slim Tube

Growth Conditions
 Gas: BTBAS/NH₃
 80/200sccm
 Pressure: 30Pa

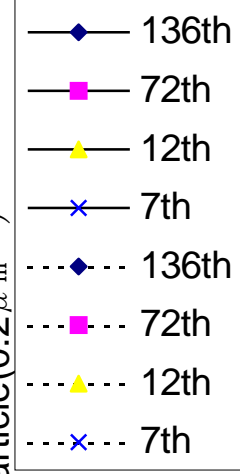
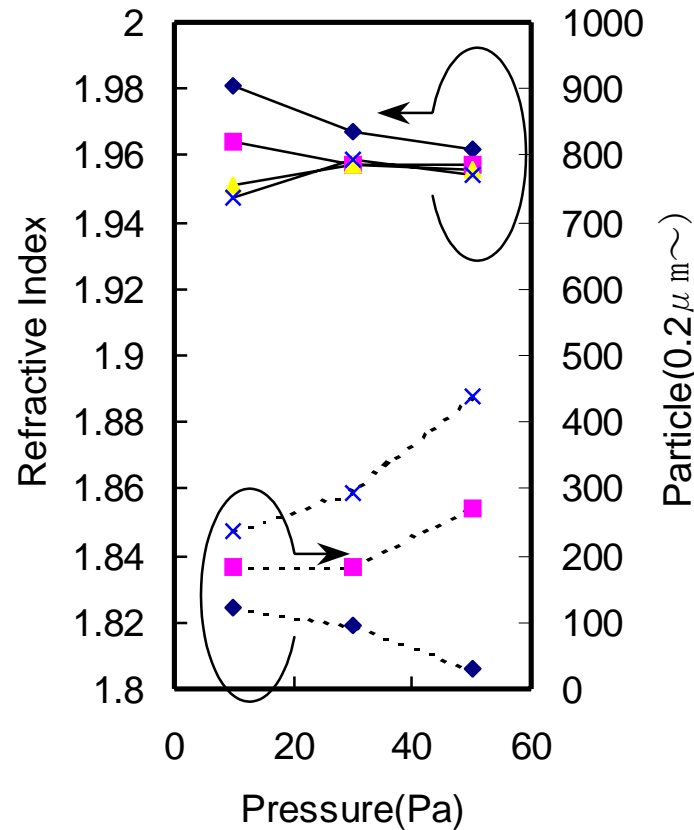
Uniformity Dependence on Pressure

Super Slim Tube

Within Wafer Uniformity and Growth Rate



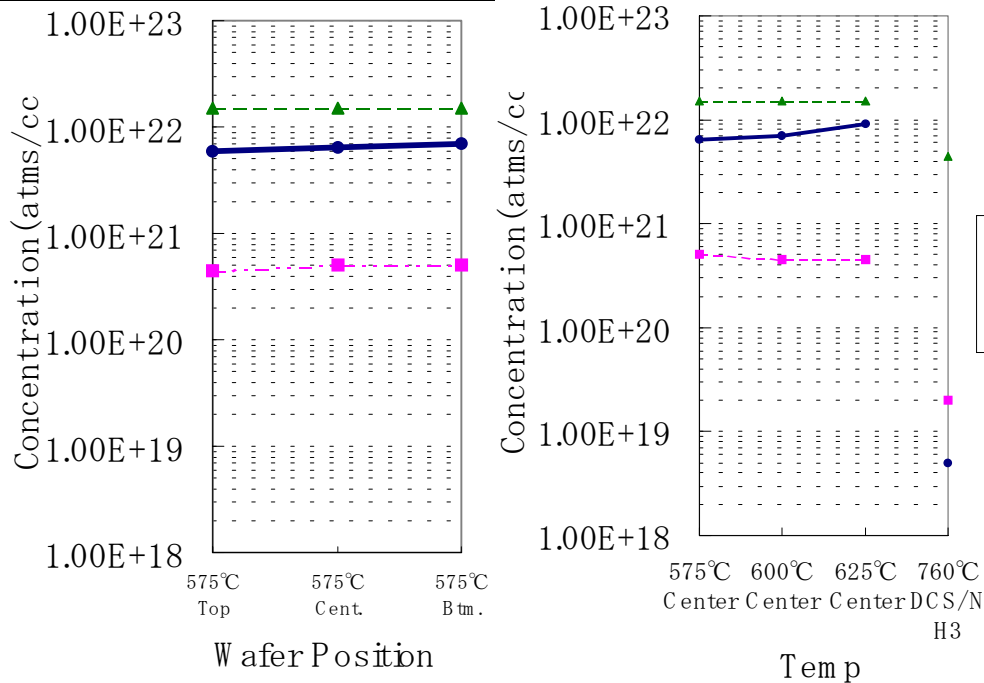
Refractive Index and Particles



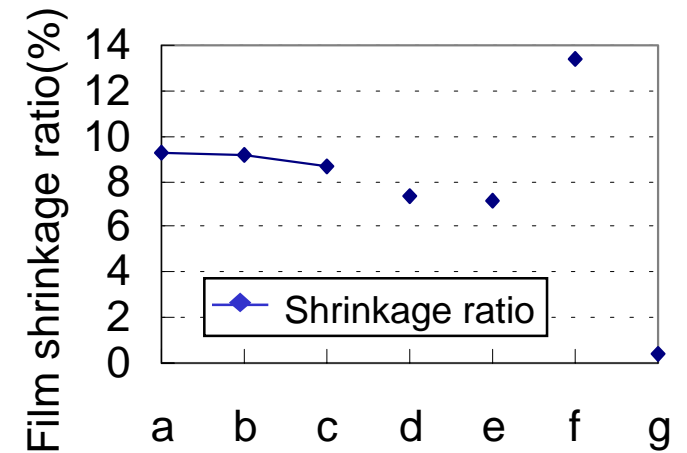
Growth Conditions
 Temp.(°C):U;615
 :CU;600
 :CL;589
 :L;583
 Gas:BTBAS/NH3
 80/200sccm

Film Quality

Carbon Concentration



Film Shrinkage ratio



Condi	Temp	Posi	NH3
a	575°C	Top	200sccm
b	575°C	Center	200sccm
c	575°C	Bottom	200sccm
d	600°C	Center	400sccm
e	600°C	Center	200sccm
f	600°C	Center	80sccm
g	760°C	Center	DCS/NH3

Film Density 2.953-3.087 g/cc

Film Stress BTBAS 14.1E9 dynes/cm²
DCS/NH₃ 11.9E9 dynes/cm²

Maintenance Cycle

- inner tube and boat change
every 10 micron (1000 * 100 Times)
- outer tube change
every 10 micron (1000 * 100Times)

Summary

- **BTBAS Nitride film is formed in the Vertical Furnace with special configuration**
- **Super Slim Tube improves the thickness uniformity**