MEIDEN
Quality connecting the next

High-concentration/high-purity ozone gas generator

Pure Ozone Generator

Safe continuous supply of High-concentration/high-purity ozone gas

O3

Pure ozone solution that only our company can realize

High-purity, high-concentration ozone “Pure Ozone” has been refined over many years by Meidensha Co., Ltd. We provide ozone solutions that only we can provide all over the world, such as oxidation source, film formation and reforming.

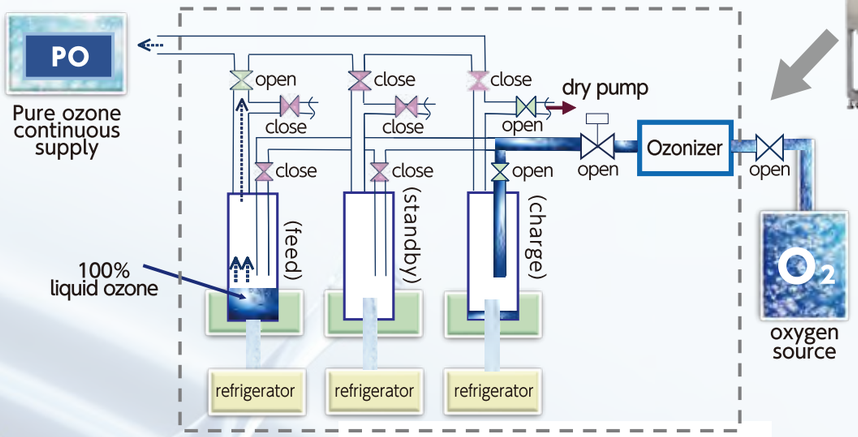
POG

Pure Ozone Generator

Joint development with the National Institute of Advanced Industrial Science and Technology (AIST)

POG : Pure ozone generation technology

- Ozone generated by an ozonizer is liquefied at a low temperature and only 100% liquid ozone is extracted.
- Continuous supply of pure ozone gas with 100% concentration is possible by vaporizing only when necessary.



Benefits of Pure Ozone

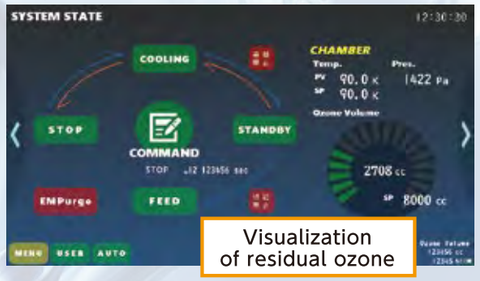
High purity : > 80% Ozone Pressure : <10,000Pa	● **Achieves over 80% ozone utilization without ozone decomposition at low temperature(*1).** ⇒**Temperature and pressure range that enables the long lifetime of ozone.** ● Pure ozone under reduced pressure is stable and is ideal for vacuum processes.
On-demand supply	● **On-demand supply of the required amount of pure ozone.** Low-concentration ozone generated by conventional ozonizer requires a constant supply of ozone during the vacuum process.
Compatible with vacuum processes	● **ALD film formation, surface modification, ashing, and cleaning are possible at low temperature(*1).**
Pure chemical reaction	● Damage-free chemical process without any physical damage as plasma and UV. ● Ideal for substrates that require low temperatures (*1), such as low heat-resistant semiconductors, resins, and films.

*1 Low temperature: Room temperature to 150˚C

Simple user interface

■ POG user interface

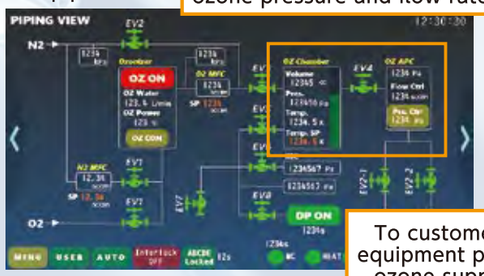
Graphical user interface



Visualization of residual ozone

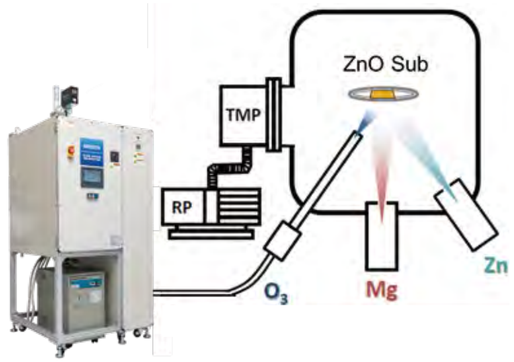
Gas pipe screen

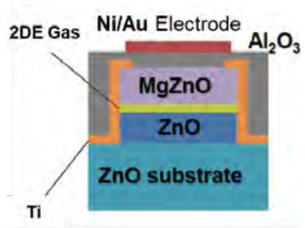
Simple input of necessary ozone pressure and flow rate



Oxidation source for MBE

■ Oxidation source application example for MBE
(Molecular Beam Epitaxy)





We have plenty of delivery track records to domestic/overseas research institutes and universities.

Functions and specifications achieved by POG

「Low impurity」
High purity (ppb) (competitor: ppm order).

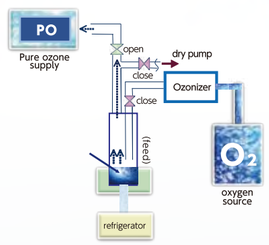
「High concentration」
Over 80% ozone concentration
(competitor: less than 20%).

「Adjustable concentration」
Ozone concentration adjustable from
20 to 80% or more.

Adjustable concentration option is available per your request. Please contact us.

■ Line-up POG for MBE

Type	Batch
Intended use	for R&D
Number of ozone chambers	1
Standard full ozone accumulation volume	16,000cc
Ozone flow rate	10～300sccm
Unit configuration	Affordable entry R&D type with one ozone chamber configuration. When Pure Ozone runs out, it will take about 2 hours to accumulate full.



Oxidation source supply for multiple ALDs

■ Example of oxidation source supply for ALD

Connection image of POG and
conventional ALD equipment

Has been adopted by a major ALD equipment manufacture

Advantages of introducing POG

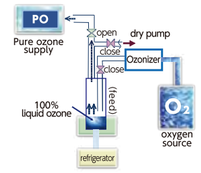
「Realization of low running cost」
Low-concentration ozone generated by an ozonizer requires constant ozone bypass flow, which makes the process inefficient.
POG supplies ozone gas when needed without unnecessary loss by keeping the gas charged in the supply piping with a constant pressure.

「Room temperature film formation (150℃ or less)」
Ideal for substrates that require low temperatures, such as low heat-resistant semiconductors, resins, and films.

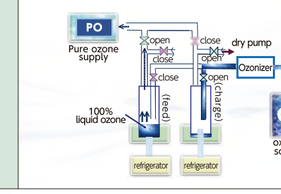
「Realization of good coverage」
Conformal coverage on sidewall and bottom of high aspect ratio trench thanks to the long lifetime of pure ozone.

■ Line-up POG for ALD

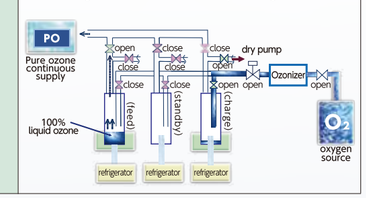
Type	Batch
Intended use	for R&D
Number of ozone chambers	1
Standard full ozone accumulation volume	16,000cc
Ozone flow rate	10～300sccm
Unit configuration	Affordable entry R&D type with one ozone chamber configuration. When Pure Ozone runs out, it will take about 2 hours to accumulate full.



Type	Quasi-continuous
Intended use	for semi-mass production
Number of ozone chambers	2
Standard full ozone accumulation volume	32,000cc
Ozone flow rate	10～150sccm
Unit configuration	A quasi-continuous supply system that repeats “feed” and “charge” by using two ozone chambers. No waiting time for ozone build-up during use.



Type	Continuous supply
Intended use	for mass production
Number of ozone chambers	3
Standard full ozone accumulation volume	48,000cc
Ozone flow rate	10～150sccm
Unit configuration	A continuous supply type that repeats “feed”, “standby” and “charge” with three ozone chambers. No waiting time for ozone build-up during use.



Pure Ozone Generator lineup

■POG lineup for each application

Type	Batch	Quasi-continuous	Continuous supply
Intended use	for R&D	for semi-mass production	for mass production
Number of ozone chambers	1	2	3
Standard full ozone accumulation volume	16,000cc	32,000cc	48,000cc
Ozone flow rate	10～300sccm	10～150sccm (1 week to month continuous)	10～150sccm (365 days continuous)
Unit size	(W)900mm (D)900mm (H)1,700mm	(W)1,100mm (D)1,000mm (H)1,800mm	(W)1,400mm (D)1,000mm (H)1,800mm
Usage	Oxidation source for MBE		
	Oxidation source for multiple ALDs	Oxidation source for multiple ALDs	Oxidation source for multiple ALDs
		Oxidation source for surface treatment	Oxidation source for surface treatment
Unit configuration diagram	Figure 1	Figure2	Figure 3

Lineups

Figure1

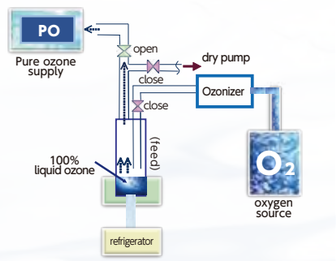


Figure2

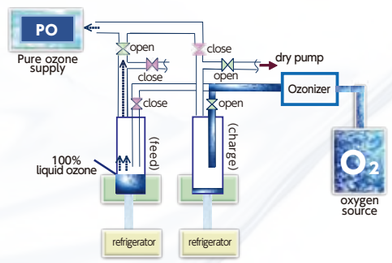
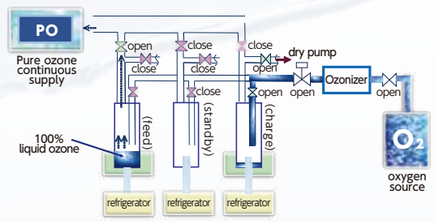


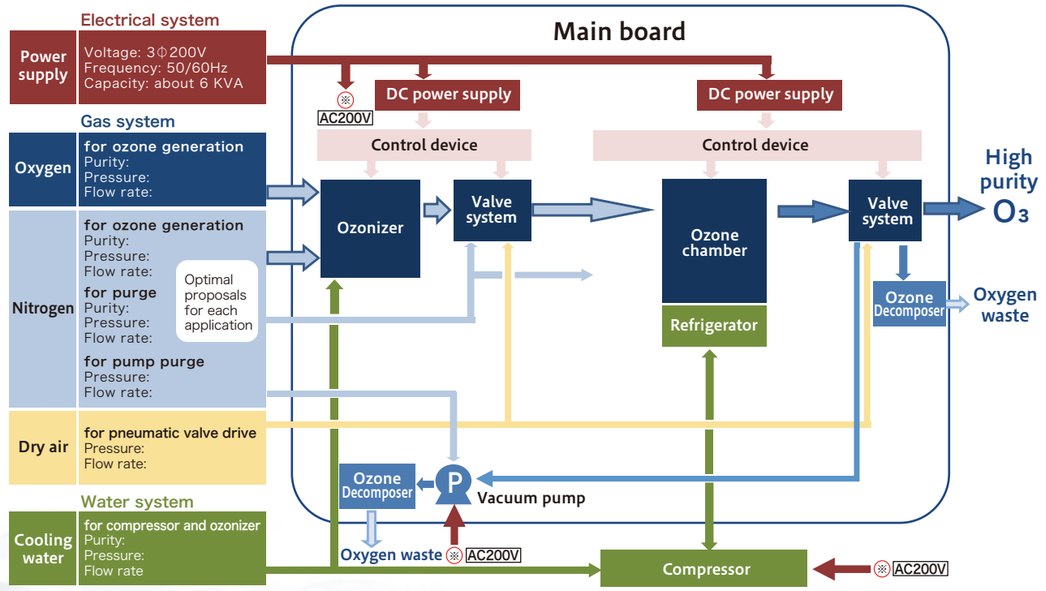
Figure3



We will propose the best configuration per your request

**Pure ozone is also available for other applications such as CVD film growth and digital etching (ALE).
Please feel free to contact us.**

Utility facility drawing



Safety measure

We design safe equipment based on the concept of keeping "high purity, low temperature, and reduced pressure to prevent uncontrolled decomposition reaction."

■Safety design

- Explosion-proof design for emergencies.
- Temperature/pressure control by fail-safe system in case of power outage.

■Reliability

- In case of a power outage, emergency purge that exhausts ozone while diluting remaining ozone with sufficient nitrogen gas operates automatically.
- The EMO (emergency stop) switch can be used to manually stop the equipment in the event of an error.
- The liquefaction chamber is installed in a vacuum-insulated SUS container, and a structure that does not cause mechanical damage to external equipment is adopted.
- The liquid ozone cooling unit has a sufficient heat capacity for the amount of accumulated liquid ozone, reducing the risk of sudden vaporization due to vibration that can be a dangerous factor.

■Standard certifications

- Some devices are certified to international safety standards (SEMI-S2, UL, NFPA, CE, etc.)

■Quality assurance

- A third party tracer gas test has been performed to ensure safety from gas leaks.

Notification application documents

We can support necessary documentation related to safety measures for installation, please contact individually.

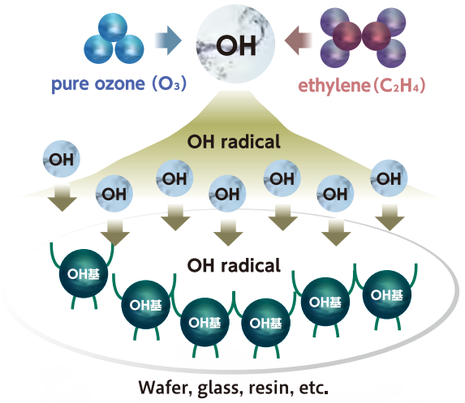
Application development of pure ozone

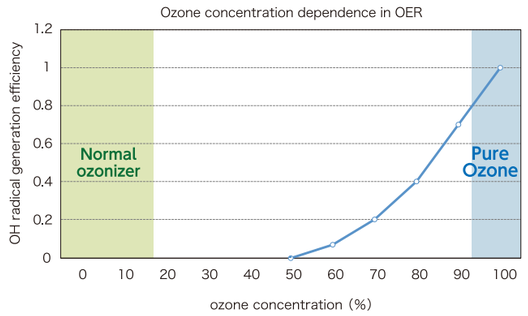
－Surface modification in low temperature range －

Mechanism of Ozone Ethylene Radical (OER) generation

Patented (patent number : 5287558)

- High-concentration ozone enables the generation of highly active OH radicals by mixing with ethylene.
- By optimizing the pressure ratio of ozone and ethylene, it is possible to maximize the amount of OH radicals generation.





Room temperature OER surface cleaning unit

Features

◆Room temperature reforming is possible
Modification at room temperature to 150℃, making the surface hydrophilic.

◆No damage
Achieves no substrate damage at room temperature, UV and plasma free.

◆Uniform treatment independent of surface shape
Uniform treatment regardless of surface shape due to high penetration of OH radicals.

◆High efficiency
Maximizing the amount of radical generation on the substrate by process optimization.

Unit specification example	
Usage environment	15～30℃、35～70%RH
Unit size	1,000mm (W)× 900mm (D)× 1,800mm (H)
Base material size	Wafer: 6 inch Substrate (glass, resin): Φ150 or 100mm square
Process temperature	Room temperature ~150℃

Uses a shower head structure (Patented)

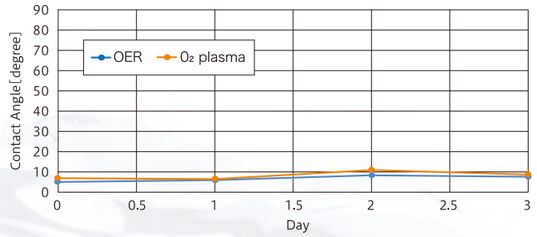
Uniform OER treatment is possible by spraying pure ozone and ethylene gas onto the base material from the shower head.

Demonstration samples of reforming and factory tours are also available. Please feel free to contact us.

OER Examples of surface modification ・・・・・・・・・・・・・・・・・・ Alkali-free glass

Liquid contact angle

Change over time

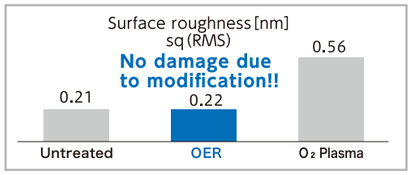


Features

- ◆Achieves a contact angle of less than 10°
- ◆Maintains smoothness without surface damage
- ◆Ideal for applications that require smoothness

Transfer process
Glass application
LCD panel
Semiconductor

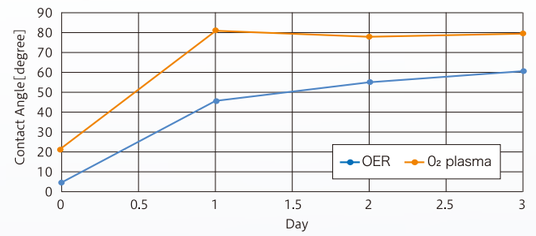
Surface roughness



OER Examples of surface modification ・・・・・・・・・・・・・・・・・・ PDMS

Liquid contact angle

Change over time

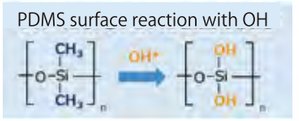


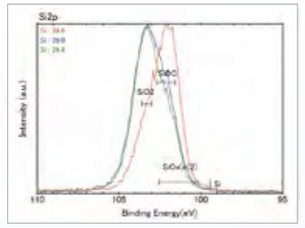
Features

- ◆Achieves a contact angle of less than 10°
- ◆Si-OH bonds are formed

Microfluidic
Nanoimprint
Contact lenses
Medical equipment

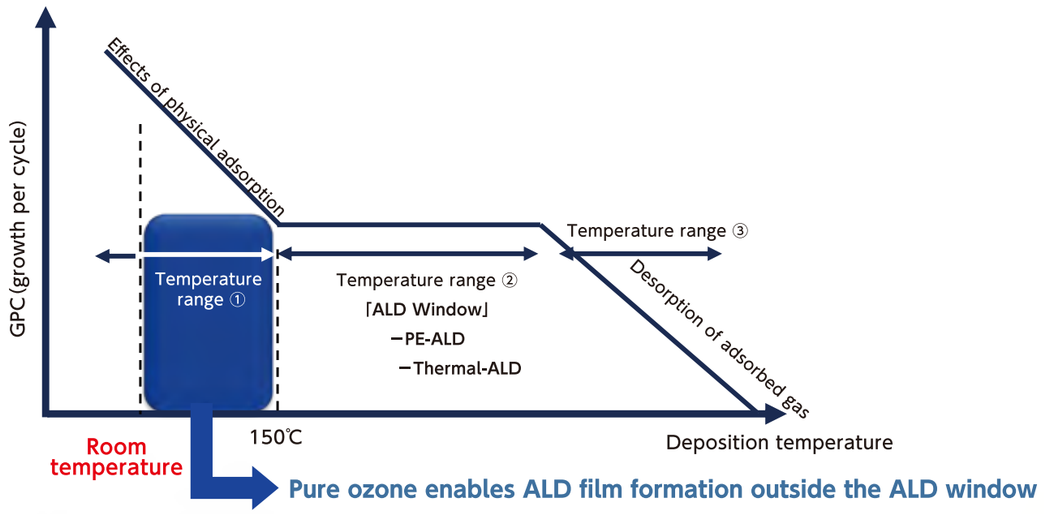
XPS analysis





— Untreated
— OER
— O_2 plasma

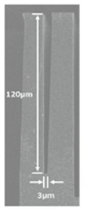
Room temperature to 150℃ Pure ozone ALD



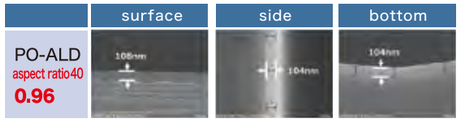
Pure ozone enables ALD film formation outside the ALD window

■ Specifications

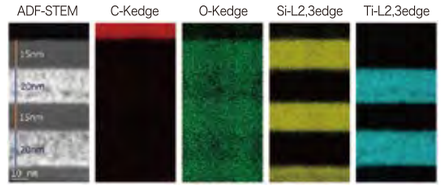
Deposition specifications	SiO_2	TiO_2	Al_2O_3		HfO_2
Deposition temperature	30～150℃	50～150℃	30～150℃		50～150℃
Deposition time	30nm ＜2.5Hr 100nm ＜8Hr	30nm ＜7Hr 100nm ＜22Hr	30nm ＜7Hr 100nm ＜22Hr	30nm ＜5Hr 100nm ＜18Hr	30nm ＜5Hr 100nm ＜16Hr
Coverage for 40:1 Trench bottom	95% or more	88% or more	82% or more		95% or more
Refractive index	1.47(at 120℃)	2.23(at 120℃)	1.57(at 120℃)	1.61(at 120℃)	1.83(at 120℃)
Precursor	Orthrus	TDMAT	DMAI	TMA	TDMAHf



Example of step coverage of SiO_2 film



Laminated film SiO_2/TiO_2 cross-sectional structure



PO ALD example "High gas blocking capability" ・・・・・・・・・・・・・ **Display, FPD**

By applying a laminated oxide film structure, higher water vapor barrier property has been obtained.

■ PO-ALD Unit appearance

Chamber furnace (image)

■ Features

◆**High Throughput：**
Our internally-built process recipe enables large volume of batch process.

◆**Damageless：**
Low temperature (150℃ or less) deposition with no plasma assist.

◆**Superior coverage to high aspect trench bottom：**
Realizes deposition on substrate with unique surface morphology (convex, uneven, double-sided, powder).

◆**Low running cost, high gas usage efficiency：**
Off-the-shelf precursors can be used with an improved gas usage efficiency.

Unit specification example	
Usage environment	15～30℃、35～70%RH
Unit size	1,350mm(W)×1,650mm(D)×1,945mm(H)
Base material size	Wafer: 12 inches or less (maximum 100 sheets) Base material (glass, resin): Φ300 or 210 mm square (up to 100 sheets) Powder: Particle size 1um or more
Deposition temperature	30～150℃ (No substrate heating)

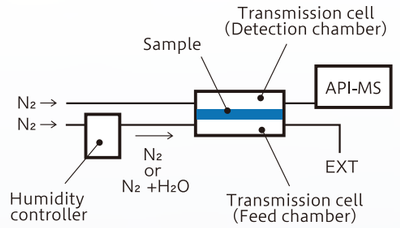
Single-wafer R&D system is also available
Please feel free to contact us for technical details, demo samples and factory tours.

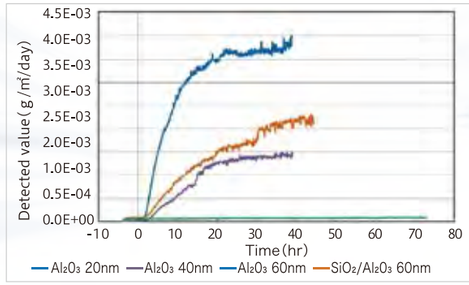
Water Vapor Transmission Rate results

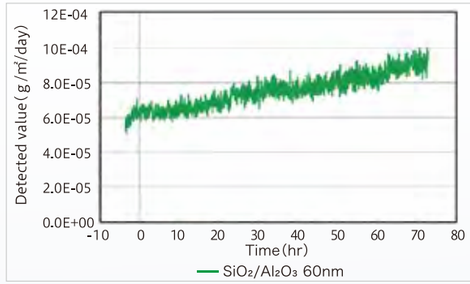
unit:g/㎡/day

Sample name	Water vapor barrier
Al_2O_3 20nm	3.6E-03
Al_2O_3 40nm	2.1E-03
Al_2O_3 60nm	1.4E-03
SiO_2/Al_2O_3 Lamination 60nm	2.8E-05

API-MS (10^{-6}～10^{-3}g/㎡/day)







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