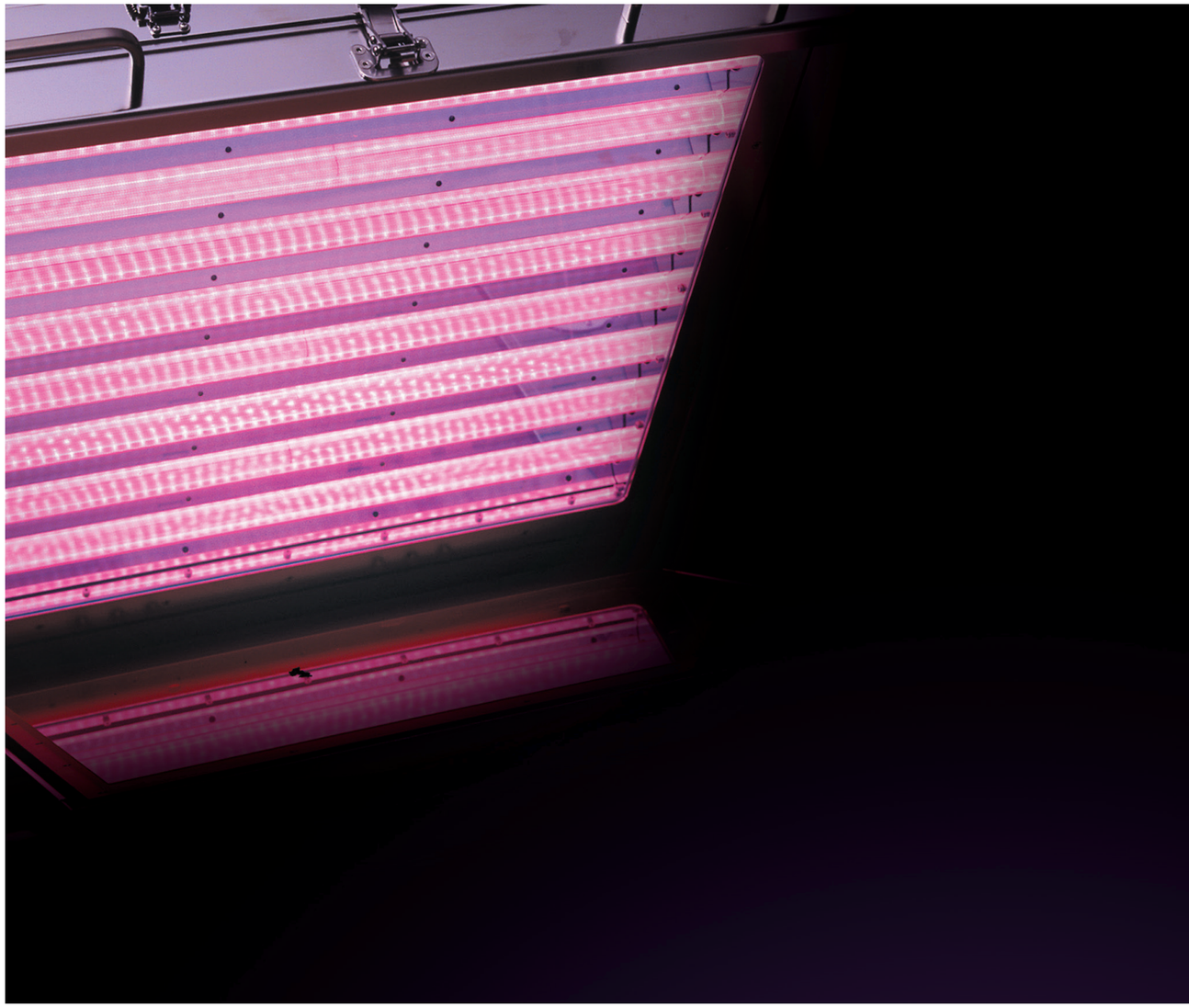
USHIO Applying Light to Life



EXCIMER

Irradiation Unit

USHIO

USHIO INC.

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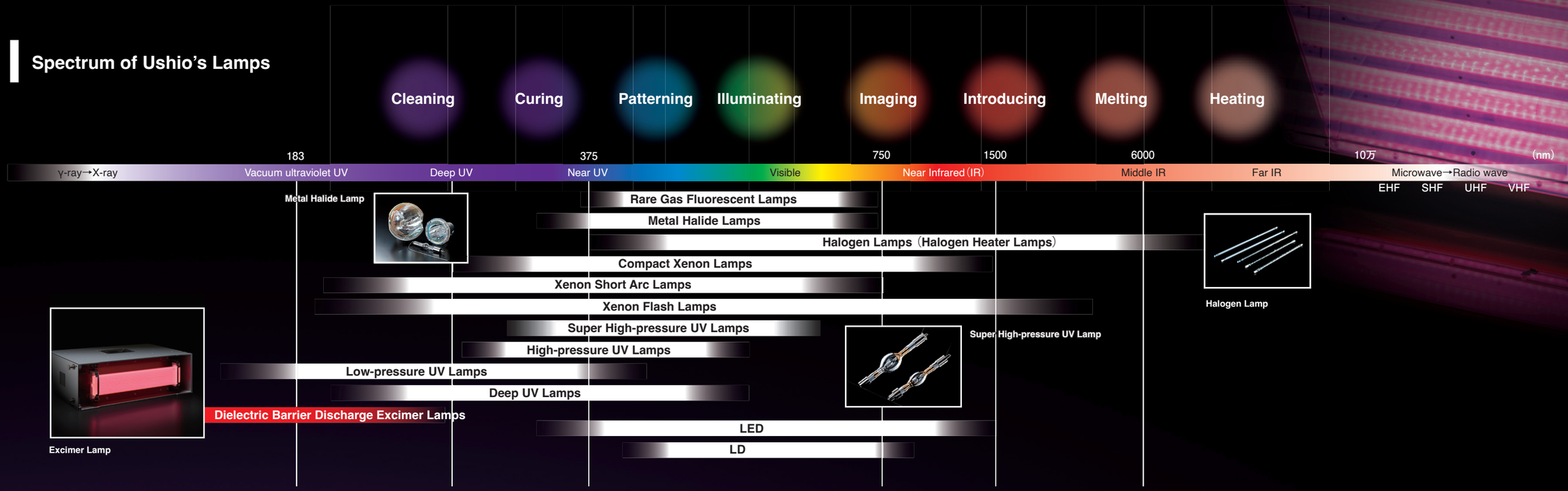
2306P①-500P①

The Solar Spectrum and Ushio's Lamps

Spectrum of Ushio's Lamps



Feature of Excimer Lamp

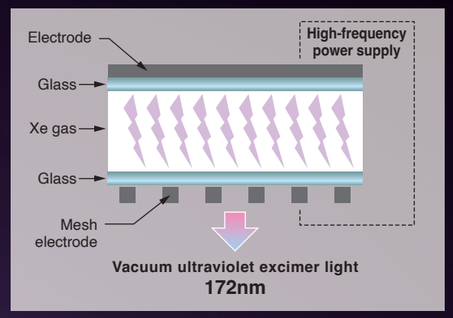
High photon energy	Single wave length	Low temperature process	Instant turn on/off	Mercury Free

Vacuum Ultra Violet

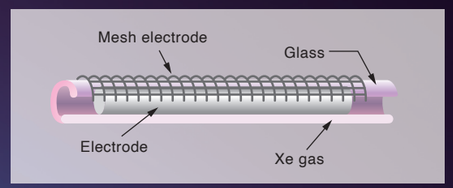
Excimer Vacuum Ultra Violet (VUV) is strong light energy generated from lamps filled with norble gas or norble gas halide compound. In case the lamps filled with norble gas or norble gas halide compound is applied high energy electron from the outside, the lamps generate discharge plasma (i.e dielectric barrier discharge). This discharge plasma includes high energy electron and instantly disappears. This discharge plasma excites the gas atoms to instantaneously produce the excimer state (Xe). When the excited state of atoms returns to the original (ground) state, the spectra peculiar to the excimer state are emitted (excimer emission). This emission light is excimer vacuum ultra violet (VUV).

Structual Example for Excimer Lamps

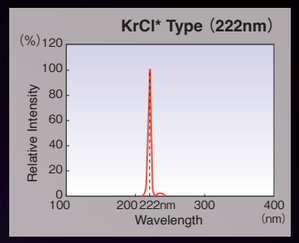
■ Flat tube

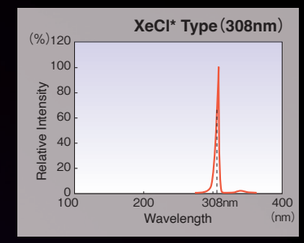


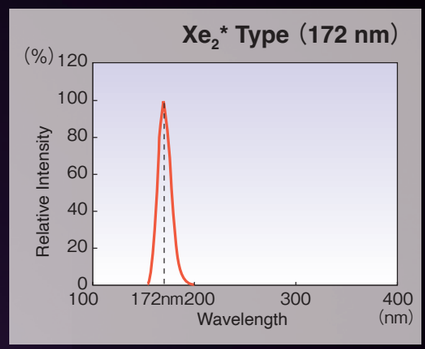
■ Round tube



Spectral Distribution

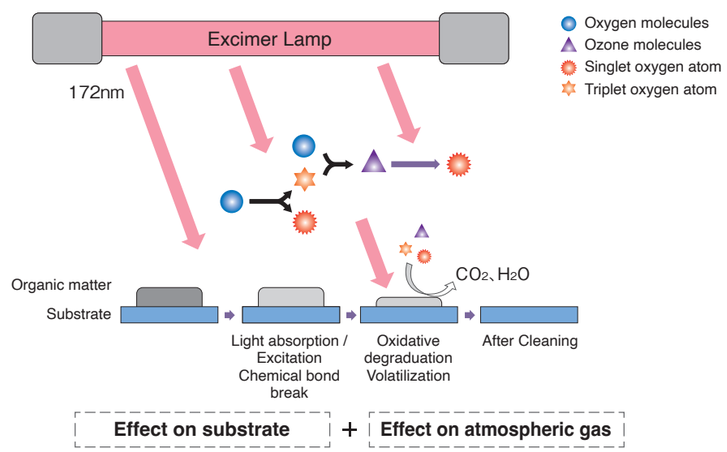






Cleaning and Modification Mechanism of Excimer Light

VUV/O_3 Cleaning with Dielectric Barrier Discharge Excimer Lamp



Effect on substrate + **Effect on atmospheric gas**

The 172nm excimer light has an absorption coefficient approx. 20 times greater than that of the 185nm UV light, thus allowing generation of a high-concentration of active oxygen species. This light is also highly efficient because it acts directly on oxygen gas to generate high oxidative excited oxygen atoms.

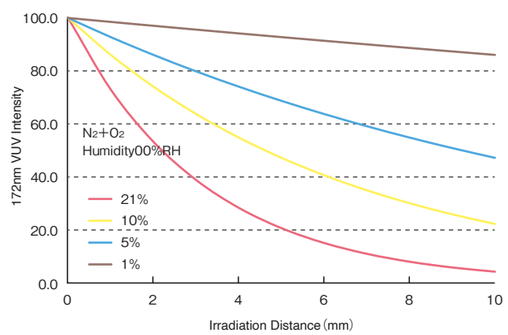
Energy of 172nm VUV Light

166.7kcal/mol

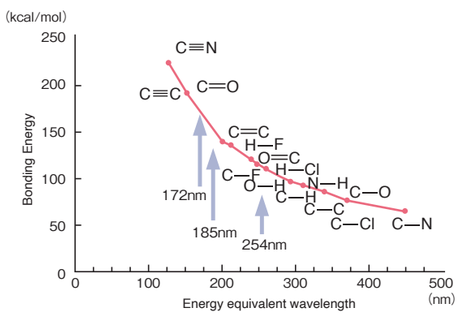
Organic Bonding Energy

C-C	84.3kcal/mol
C=C	140.5
C-H	97.6
C-F	115.2
C-Cl	76.9
C-N	63.6
C-O	76.4
C=O	190.0
O-O	32.9
O=O	117.5
O-H	109.3
H-F	134.9
H-Cl	101.9
N-H	91.9
Si-O	150.0

172nm VUV Intensity Decay Rate According to O_2 Concentration

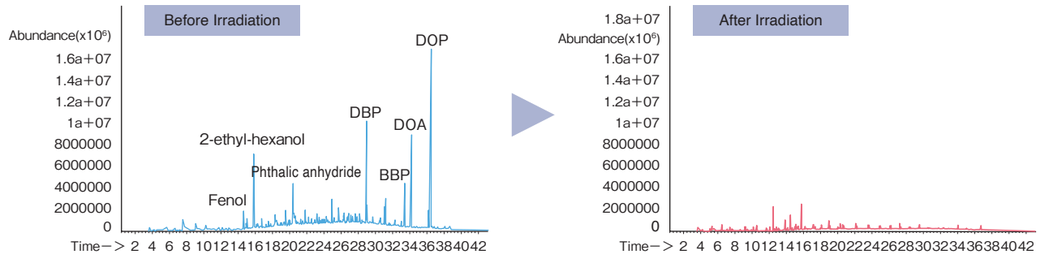


Organic Bonding Energy and Wavelength*

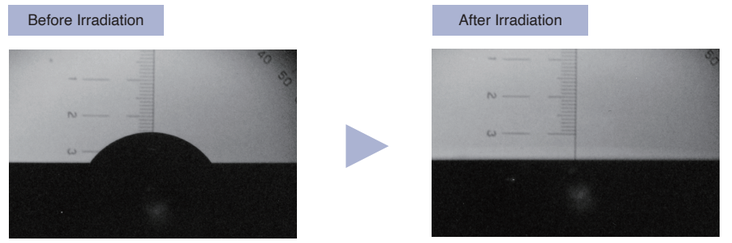


*This graph simply compares the magnitude of light energy to bonding energy, and does not indicate that irradiation with light exceeding the bonding energy will result in dissociation. Dissociation also requires conditions such as light absorption and dissociative type excitation potential.

Result of Evaluation by Thermal Desorption GC/MS Analysis



Change of Water Contact Angle

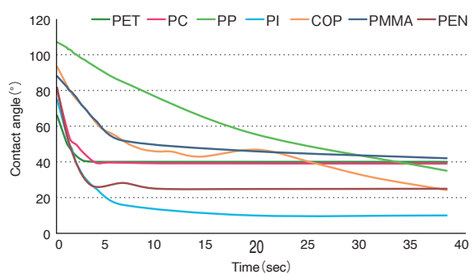


Process Conditions

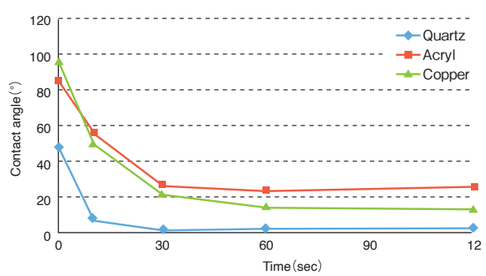
Radiation time	10 seconds
Sample	Non-alkali glass
Atmosphere	In atmospheric air
Working distance	2mm

Contact angle 50°→ 5° or less (less than measurement limit)

Change in Contact Angle for Various Organic and Inorganic Substrates



Irradiation intensity: 50mW/cm²
Working distance: 1mm

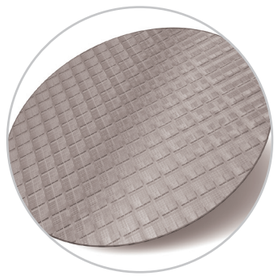


Irradiation intensity: 40mW/cm²
Working distance: 4mm

Application of Excimer Light

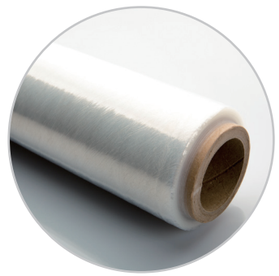
FPD／OLED

Semiconductor



Package

Film

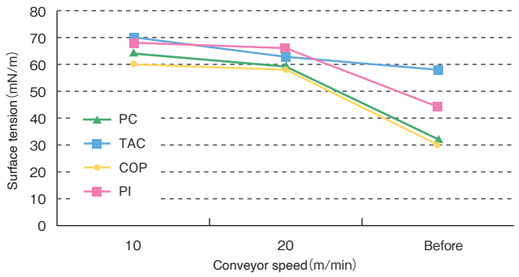


Automotive Parts

Medical

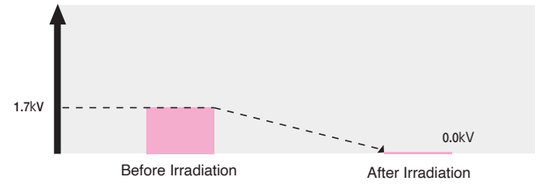
Evaluation Example

Wettability improvement of film substrate

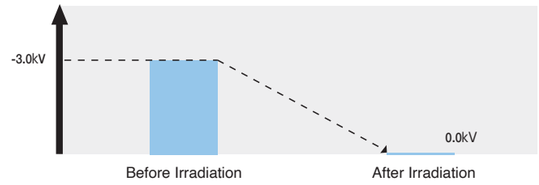


Pre-processing of different sample types

■ When charged positively

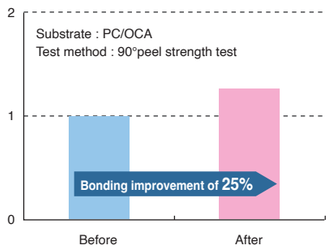


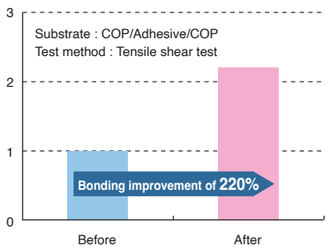
■ When charged negatively

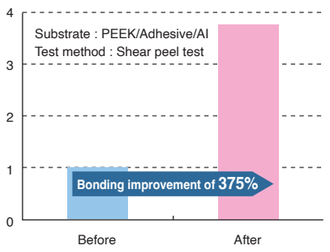


Erace static electricity while dry cleaning the substrate surface

Example of adhesion improvement

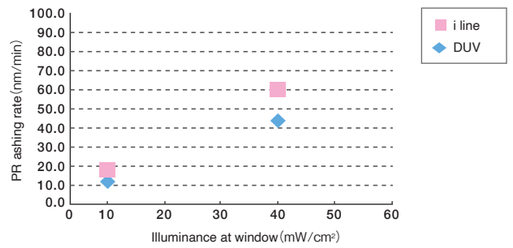




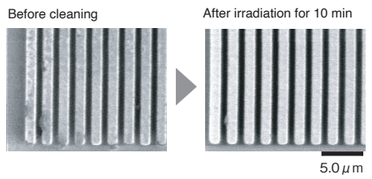


* Degree of adhesion improvement varies greatly according to substrate.

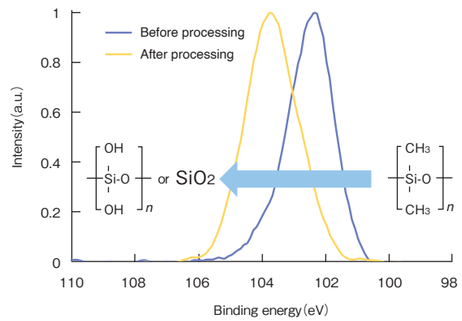
Damage-free UV ashing



■ **Cleaning nanoimprint molds**



SiO_2 conversion of silicone resin surface



Features of Excimer Light

World's first successful commercialization of this type of product

In 1993, excimer lamps were the first products launched by USHIO.

Cumulative shipment of 6,000 units

Focusing on the FPD industry, as of 2022 we have shipped a total of more than 6,000 units.

High market share

As a leading manufacturer of excimer lamps, we constantly work to advance research & development and to expand out lineup to meet the needs of our customers.

Collaboration / Open Innovation

For customers who are considering the purchase of our products, demonstration units may be loaned out, with a Application Laboratory Facilities available.
Witnessed experiments or experiments using an customer provided sample can be conducted. Upon completing an experiment, we conduct analysis and assessment (XPS,FT-IR,FE/SEM etc), and then send an experiment report to each customer.
Any customer interested in the above should submit an application from our Homepage or contact the Business Division.

* Note that it may be difficult for us to satisfy certain customer requests depending on the contents of an experiment or analysis. For details, please contact us for further information in advance.

For a witnessed experiment:
Inform us of the contents of the desired experiment or send/deliver a workpiece to us in advance. We will be able to start an experiment soon after you visit us.

For an experiment with an customer provided sample:
Inform us of the contents of the desired experiment in advance and send us a workpiece.

A rich light source lineup

We make a broad lineup of equipment, ranging from laboratory verification equipment to mass production facilities.
We can propose customizations to meet individual customer requirements. With its outstanding productivity, the HP-V series enjoys a particularly high reputation.

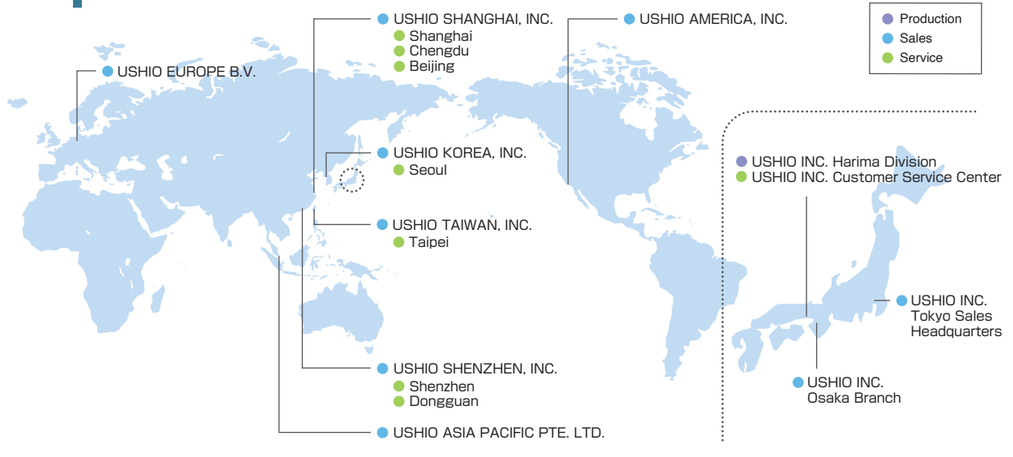
- **High cumulative exposure by wide, flat tube structure**
- **High radiation emittance by proprietary reflective film technology**
- **Covers widths of up to 3,400 mm with a single lamp**

Achieves processing with minimal number of lamps. Contributes to CoO reduction.

Support Organization

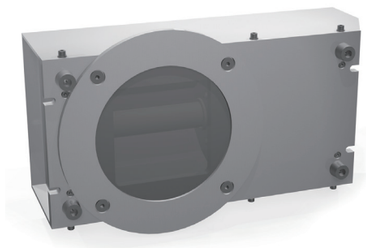
Ushio Group provide support program such as spare parts sales, tool maintenance, relocation, modification or calibration.
Customer service center in Japan collaborate with worldwide service office to provide quick and convenient support.
We support preventing your tool from any troubles by proposing preventive maintenance program.
Please use our support program for comfortable operation and optimization for market and technical needs change.

Location



Product Lineup

Surface light source; window size 100 x 100mm



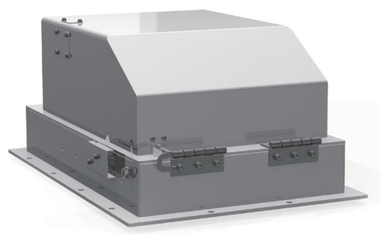
■ Specifications

Model	Atmosphere	Radiant emission
SSP04A-***	Normal atmosphere	Over 20mW/cm²
SSP04V-***	Vacuum	Over 18mW/cm²

■ Utilities

Electricity	Nitrogen
AC100 or 200V 0.1kVA	4.5~5.5NL/min(purity of 99.99% or more)

Surface light source; window size 170 x 170mm／SSP06 Series



■ Reference specifications

Window size	Radiation uniformity	Radiant emission
170 x 170mm	±15%	12mW/cm²

* The radiation uniformity and irradiance may vary depending on individual designs.

■ Utilities

Electricity	Cooling water	Nitrogen
AC100 or 200V 0.6kVA	1.5~3.0L/min (tap water at 30°C or lower)	20~30NL/min (purity of 99.99% or more)

Surface light source; window size 340 x 340mm／SSP12 Series

■ Reference specifications

Window size	Radiation uniformity	Radiant emission
340 x 340mm	±10%	50mW/cm²

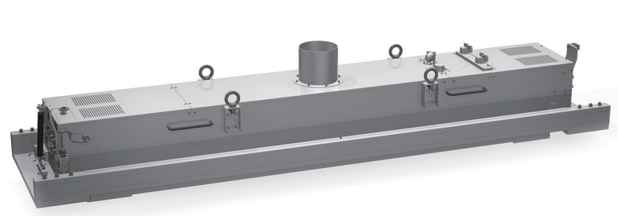
* The radiation uniformity and irradiance may vary depending on individual designs.

■ Utilities

Electricity	Cooling water	Nitrogen
AC220V±20V 3kVA	5~6L/min (tap water at 30°C or lower)	40~50NL/min (purity of 99.99% or more)

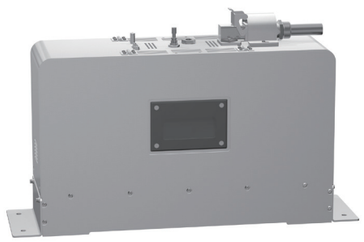
HP-V Series

Accommodates substrate sizes up to 3,400mm.
Achieves the industry's highest illuminance: a minimum of 170mW/cm² with an average of 190mW/cm².



HPV-ST Series

Compact in size while maintaining the performance of the HPV series

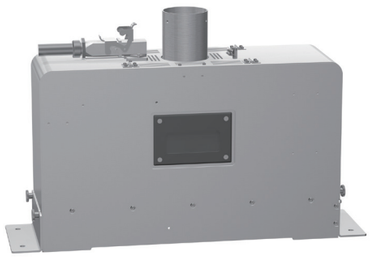


STN Series

■ Specifications

Model	Process gas	Irradiation area	Radiant emission
STN3-***	Required	up to 300mm (width)	Over 170mW/cm²
STN5-***	Required	up to 550mm (width)	

* 100V/200V specification for 300 mm width, 200V specification for 550mm width



STA Series

■ Utilities

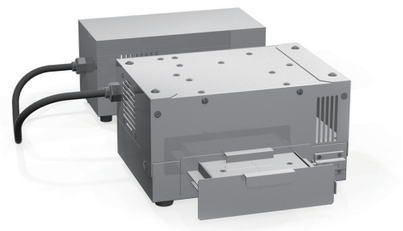
Model	Process gas	Irradiation area	Radiant emission
STA3-***	Not required (air intake)	up to 300mm (width)	Over 170mW/cm²
STA5-***	Not required (air intake)	up to 550mm (width)	

* 100V/200V specification for 300 mm width, 200V specification for 550mm width

Product Lineup

Please contact our sales representative for available options and detailed specifications.

Small experimental unit; Min-Excimer



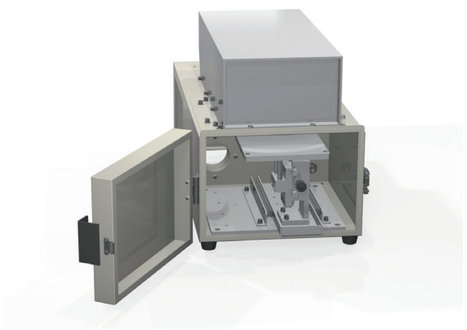
■ Reference specifications

Aperture dimensions	50 x 80mm, *No window
Radiant emission	10mW/cm² (Reference value)
Irradiation distance (lamp to stage top)	4 , 14 , 24 mm
Rough size (excluding protrusions and lighting)	W211 × D239 × H117 (mm)

■ Utilities

Electricity	AC100V 0.15KVA
Cooling water (tap water)	—
Exhaust	0.1～0.2m³/min
Gas for lamp housing	—
Gas for processing chamber	—

Small experimental unit; window size 100 x 100mm



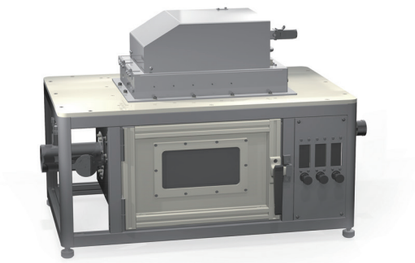
■ Reference specifications

Irradiation area	100 x 100mm
Radiant emission	Over 20mW/cm²
Irradiation distance (window to stage top)	4~25mm (when equipped with elevating mechanism)
Rough size (excluding protrusions and lighting power supply)	W250 × D500 × H325mm

■ Utilities

Electricity	AC100V 0.3KVA
Cooling water (tap water)	—
Exhaust	0.1～0.2m³/min
Gas for lamp housing	N₂ : 5～6NL/min
Gas for processing chamber	N₂:0～50NL/min CDA:0～1NL/min

SVK Series (Bench-top exposure unit)



■ Reference specifications

Irradiation area	～230 x 230mm
Radiant emission	Over 12mW/cm²
Irradiation distance (window to stage top)	3～110mm (When equipped with elevating mechanism)
Rough size (excluding protrusions and lighting power supply)	W760 × D480 × H560mm

■ Utilities

Electricity	AC100V 0.7KVA
Cooling water (tap water)	1.5～3L/min
Exhaust	～1m³/min
Gas for lamp housing	N₂ : 20～30NL/min
Gas for processing chamber	N₂ or CDA : 0～100NL/min

SVC Series (Standalone unit for large substrates)

Provides precision control over variables such as oxygen density and substrate temperature. Presumes manual placement of substrate.

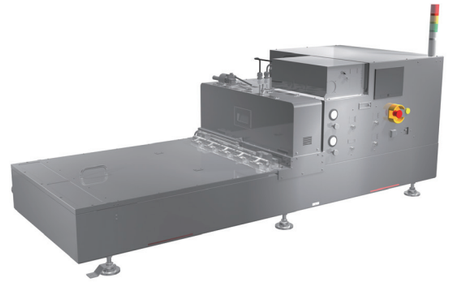
■ Reference specifications

Irradiation area	～340 x 340mm
Radiant emission	Over 50mW/cm²
Irradiation distance (window to stage top)	3～100mm
Rough size (excluding protrusions and lighting power supply)	W1020 × D1150 × H1720mm

■ Utilities

Electrical capacity	AC200V 4.0KVA
Cooling water (municipal supply)	5～6L/min
Exhaust	1.5～2.0m³/min
Gas for lamp housing	N₂ : 40～50NL/min
Gas for processing chamber	N₂:0～100NL/min CDA:0～25NL/min
When vacuum fixing of substrate is required	CDA:40NL/min

SVS／SVSA Series (Stage conveyor with material handling mechanism for large substrates)



■ Reference specifications

Irradiation area	～300 x 420mm
Radiant emission	Over 170mW/cm²
Irradiation distance (window to stage top)	3～40mm
Rough size (excluding protrusions and lighting power supply)	—
Conveyor speed	0.5～5.0m/min

* Approximate size and utilities vary according to unit size. Please contact our sales representative for details.

* Available with or without process gas (intake type)

Film Excimer Series (Horizontal conveyor type)

Provides 50% reduction in N2 flow rate. Allows control over oxygen concentration even during high-speed substrate handling.

■ Reference specifications

Irradiation area	up to 1500mm (width)
Radiant emission	Over 170mW/cm²
Irradiation distance (window to stage top)	4mm(Adjustable)
Rough size (excluding protrusions and lighting power supply)	—

* Approximate size and utilities vary according to unit size. Please contact our sales representative for details.

Related Products

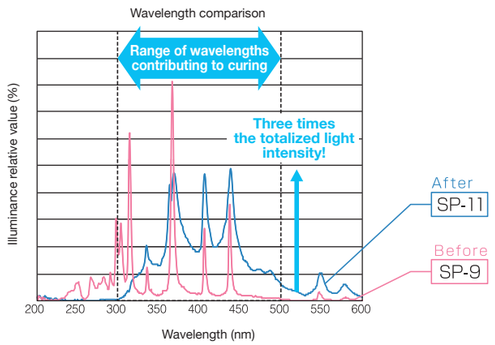
Atmospheric Pressure Plasma Irradiation Device

A total solution for surface treatment together with an excimer irradiation device.

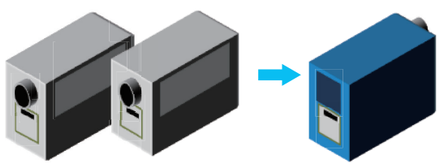
- ☐ Features an integrated power supply for slim design
- ☐ Low temperature treatment
  Low damege
- ☐ Low power, highly effective surface treatment

Spot UV-Curing Unit

- ☐ Broad spectrum of wavelengths increases irradiance to 3 times more than before
  Curing time down to 1/3



- ☐ High-level irradiance, requiring only half the number of apparatuses



Specifications

Model	SP-11_275A
Light Source	Preset 275W UV lamp
UV irradiation	6500mW/cm²(previous: 4080mW/cm²) [Conditions] Ushio fiber SF-101AQ, irradiation distance 15mm, Ushio intensity meter: UVD-S365 (photoreceptor ø1mm) [Remarks] SP11 UV wavelength measurement is limited with Ushio irradiometer; use values as a guide. Curing speed is therefore faster with broad-spectrum curing provided with this apparatus depending on the work material.
Lamp life	2000 hours / 50% of initial UV irradiance
Shutter	Motor shutter timer/manual controllable Timer settings: 0.5 – 999s (0.1-s steps), 1000 – 9999s (1-s steps)
Weight	Approx 8.3kg

* Spot UV-LED Curing unit is also available.

UV-LED Curing Unit

■ E Series (Generation 2)

- ☐ Both HD and HC types are available
- ☐ 10%～100% dimmable
- ☐ Scalable by edgeless design
- ☐ Built-in LED driver

Specifications

E series (GEN2) Standard type		HD		HC	
		E075Sd HD	E110Sd HD	E075Sd HC	E110Sd HC
Window Size (mm)		75×17	108×17	76×ϕ10	109×ϕ10
Width (mm)		78	111	78	111
Length (mm)		33			
Height (mm)		134.5		143.2	
Peak Irradiance(W/cm²)	365nm	8.4(WD=0mm)/ 3.5(WD=5mm)*1		6.0（WD=10mm）*1	
	385nm	10.8(WD=0mm)/ 4.6(WD=5mm)*1		7.2（WD=10mm）*1	
	395nm	12.8(WD=0mm)/ 5.1(WD=5mm)*1		8.5（WD=10mm）*1	
	405nm				
Accumulated quantity of light (mJ/cm2, 50m/min)@365		46		42	
Accumulated quantity of light (mJ/cm2, 50m/min)@365, 395, 405		54 / 60 / 60		50 / 59 / 59	

*1 Reference value based on measurement by Ushio.　* A single power supply is also available as an option.

■ iIV Series

- ☐ Achieves high irradiation of up to 18W/cm², WD=5mm*1
- ☐ Achieved approx. 240% increase of dosage than iII series
- ☐ 25% more compact than iIII
- ☐ 25% lighter than iIII
- ☐ Quiet design
- ☐ 15%～100% dimmable
- ☐ Built-in LED driver
- ☐ Replaceable UV-LED board

Specifications

W Series		i075Ⅳ	i150Ⅳ	i225Ⅳ	i300Ⅳ	i375Ⅳ	i450Ⅳ	i525Ⅳ
Window Size (mm)		75×52	150×52	225×52	300×52	375×52	450×52	525×52
Width (mm)		77	152	227	302	377	452	527
Length (mm)		136						
Height (mm)		256.4						
Peak Irradiance (W/cm²)	365nm	13.5(WD=0mm)/ 13.0(WD=5mm)*2						
	385nm	17.0(WD=0mm)/ 16.0(WD=5mm)*2						
	395nm	19.5(WD=0mm)/ 18.5(WD=5mm)*2						

*1 Available for 395nm　*2 Reference value based on Ushio measurement.

Related Products

UV Intensity Meter

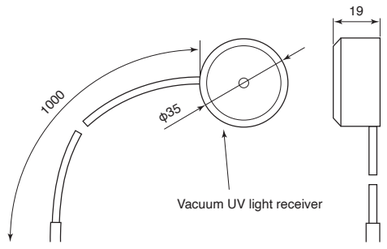
VUV-S172/UIT-250

- Measures the irradiance, peak irradiance, and integrated light quantity of 172-nm excimer light.
- Measures irradiance for up to four minutes with mounted memory.
- Can be connected between the main unit and light receiver by a 2-meter extension cable(option).
- Switches between ON and OFF of auto power.
- Features a seril communication function with a PC.

Specifications

Model	UIT-250(main unit)
Display	Liquid crystal display(4-digit irradiation, 5-digit integrated light quantity)
Function	Real-time irradiance, peak irradiance, integrated light quantity, 3-step range switching, auto power OFF(in 5 minutes)
Irradiance distribution output	Analog 0 to 1V output, maximum recording time of 2 or 4 minutes(with recorder connected)
Sample rate	16 or 32 samples per second
Communication specifications	Communication specifications: Half-duplex; Synchronization system: Start-stop synchronization (asynchronous); Baud rate: 4800 bps (fixed;) Transmission code: ASCII; Date length: 8 bits (fixed); Stop bit: 1; Parity: None; Delimiter: CR
Dimensions(mm)	75(W)×160(D)×15(H)
Weight(g)	250 g or less, main unit only (without batteries)
Power supply	LR04 buttery x 3

■ Light receiving unit VUV-S172



When using this monitor, confirm that the models and serial numbers of the vacuum UV light receiver and sensitivity adjusting adapter match. If these models and serial numbers do not match, the values displayed on the UT-250 main unit do not reflect the actual display values.

Specifications

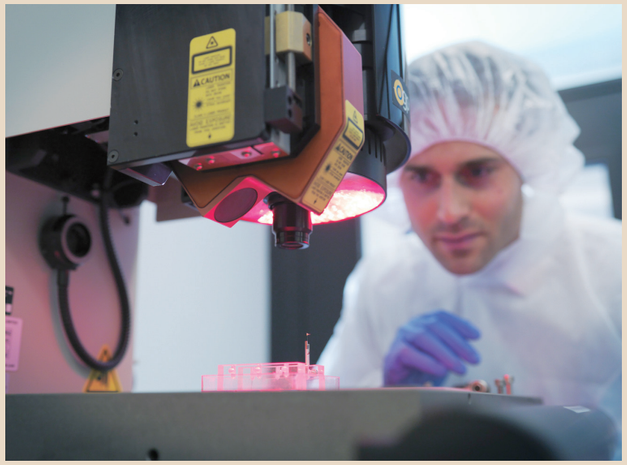
Model	VUV-S172(light receiving unit)
Sensitivity wavelength range	150nm～400nm
Sensitivity wavelength range	Center wavelength: 172-nm full width at half maximum: 14-nm excimer light
Light receiving diameter	ϕ4mm
Measurable temperature range	0～50°C
Emission irradiance measuring range(mW/cm²)	H range 0～999.9 M range 0.0～99.99 L range 0.00～9.999
Dimensions	See External View.
Weight	About 57 g

Guide to Application Laboratory Facilities

Ushio Techno Lab

Ushio Techno Lab introduces optical technology and its applications that Ushio has cultivated over the years.
We have set up a joint laboratory equipped with experimental equipment and devices that provide various wavelengths of light for irradiation over a wide range, from vacuum ultraviolet light to visible and infrared light, along with a variety of equipment for measurement and analysis.

Activities possible at Ushio Techno Lab



At this lab, customers can join Ushio in developing solutions that make use of Ushio's optical technology and know-how to develop new materials and applications, improve production processes or consider undertaking mass production, establish environmental adaptation technology, and resolve bottlenecks in their research processes. We hope you will take full advantage of this facility. If you would like to use the Ushio Techno Lab, please contact us through our Web site or our sales representative.

■ Examples of experiments

VUV irradiation experiments	Surface modification using VUV irradiation in a vacuum
Heating experiments	Flash lamp/halogen lamp heating experiments
LED and Laser diode	UV curing, projection, and flow visualization experiments
Patterning experiments	Pattern formation on photoresists
Photo Alignment experiments	Development of anisotropy in materials using polarized UV irradiation
Hardening experiments	Curing using ultraviolet light
Microfabrication experiments	Lithographic processing of curved surfaces and patterning of hard-to-work materials
Light functionality tests	All sorts of testing and fabrication using special optical parts

*Note that we may not be able to accommodate all requests depending on the type of experiment or analysis.
*The Ushio Techno Lab is also available at local entities belonging to the Ushio group in other countries. Please contact us for more details.

Continually Striving for Optimum Light

Striving for the satisfaction of each individual customer,
Ushio provides "light support" services according to needs and objectives.

Support Flow

Requests and Inquiries

Please contact the customer-support center below.

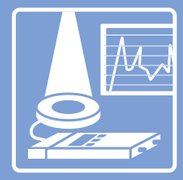
Communicate

Our representative will contact you to discuss needs and requirements.

Get Service

We always provide the most favorable program of support proposals and service. When needed, reference estimates can be provided in advance.

Support Program



Calibration of Optical Measuring Instruments

USHIO calibrates light measuring instrument sent to designated facilities under an ISO9001-based quality control system.

Repairs

We perform repairs of products sent to our designated repair facilities. We can also provide overhauls and substitutes as needed.

On-site Repair

Our service personnel visit customer sites to make repairs or restore devices.

Shipment of Maintenance Parts

We select and ship needed replacement parts. In some cases, we can visit customer sites to install such parts.

Periodic Inspection and Maintenance

Periodic inspection is recommended to ensure safe operation of equipment. During periodic inspection, we evaluate equipment performance and the condition of consumable items and component wear.

Others

We provide services according to customer needs, such as relocation and modification of equipment. Please feel free to contact us.

Customer Support Center

6409 Moto-Ishikawa-cho, Aoba-ku, Yokohama-shi Kanagawa 225-0004

Reception Hours 9:00-17:00
(excluding weekends and holidays)

Mail
techsup@ushio.co.jp

TEL
+81 45-901-2509

FAX
+81 45-901-2607

*A charge is assessed for this service. Means of account settlement, and return shipping location and method must be arranged in advance.
*Applies only to products of Ushio Inc. or companies who are members of the Ushio group.

Supported Products

Please feel free to contact us regarding products or services not listed. We look forward to serving you.

1. Lithography tools
2. TAB exposure system
3. ODF;UV Irradiation Equipment for One Drop Fill
4. UV curing system
5. Spot UV curing equipment
6. UV irradiance unit
7. Lamp houses
8. UV photoresist curing systems
9. Excimer irradiation unit
10. Light measurement instruments