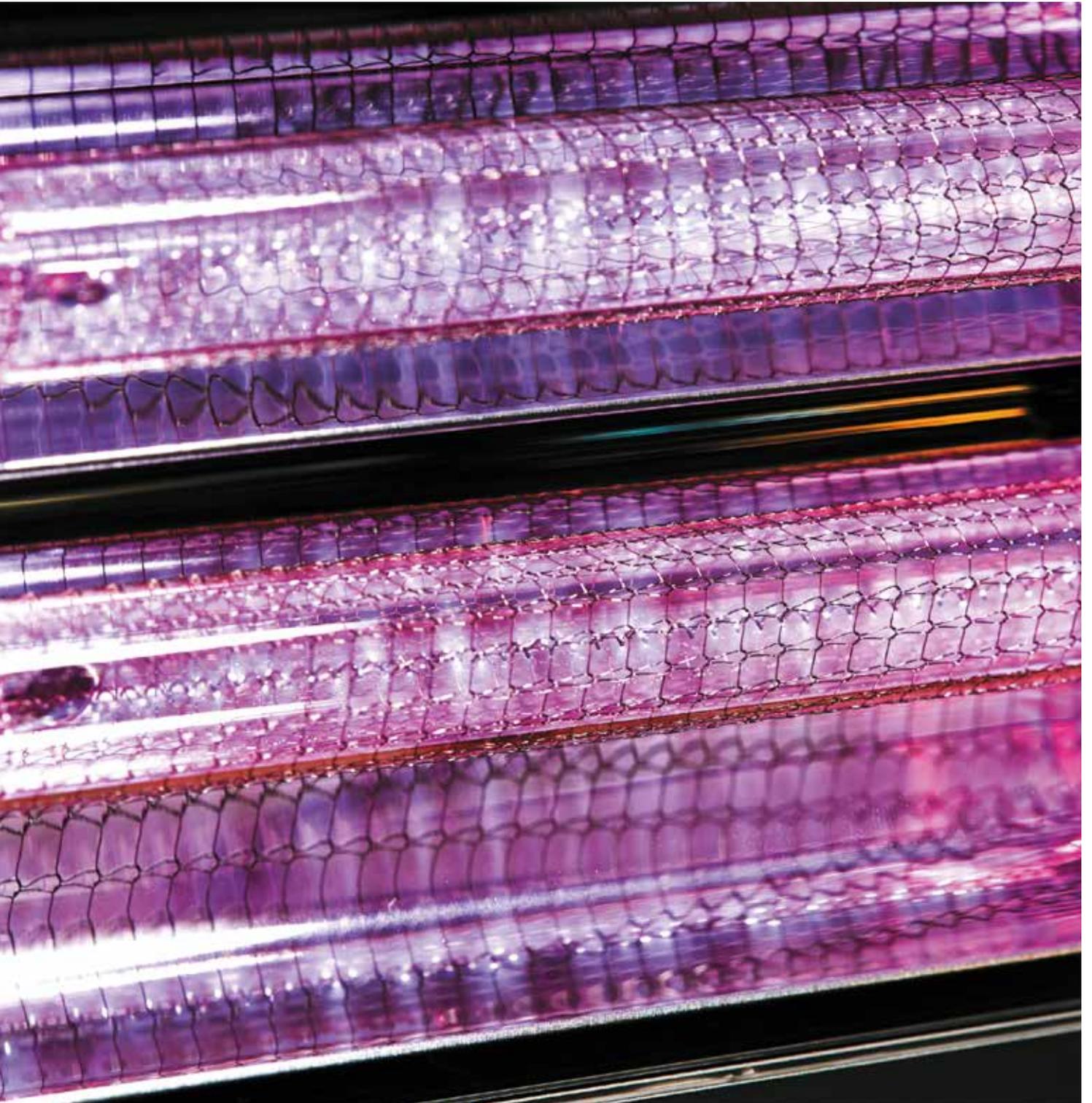


USHIO

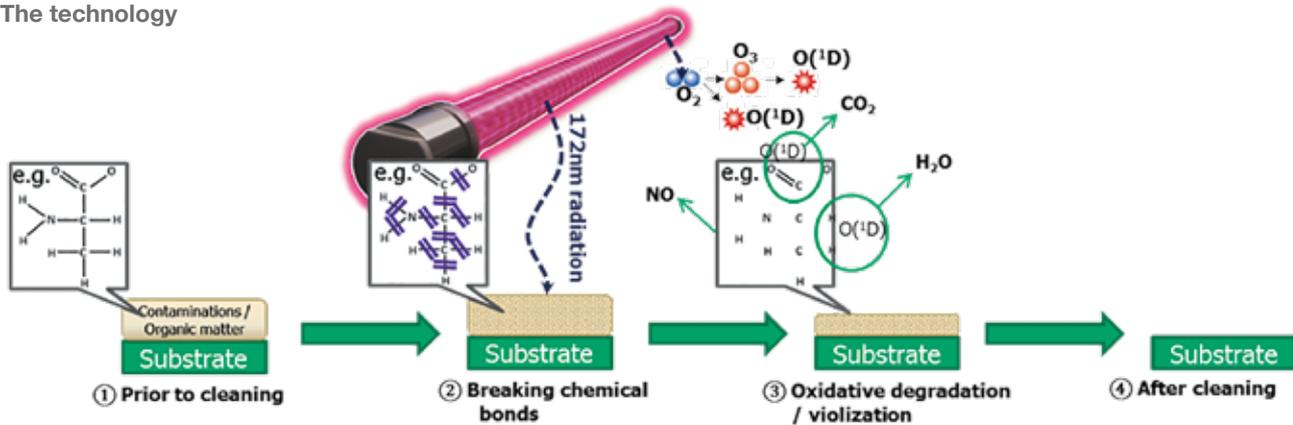
Bespoke and purpose-driven

Excimer Irradiation Solutions



Excimer Irradiation

The technology



Principle of excimer lamps.

Excimer irradiation is the strong light energy that is generated when lamps filled with noble gas or noble gas halide compound, are pressured by high-energy electrons.

TECH TALK - When high-energy electron pressure is applied from the outside onto lamps filled with a noble gas or a noble gas halide compound, the lamps release a discharge plasma (e.g. electric barrier discharge). This discharge plasma consists of high-energy electron and disappears instantly. This discharge plasma however does excite the gas atoms inside to instantaneously produce the excimer state (for Xenon excimers: Xe₂). When the atoms return from their excited state to their original (ground) state, the excimer-specific spectrum is emitted. This emission light is the VUV or UV-C light caused by excimer irradiation.

The excimer key benefits

- high photon energy
- optimized spectra – from single wavelength and narrow bandwidth radiation to continuous broad band spectra from additional phosphors
- low temperature process / "cold" radiation
- instant turn on/off function
- easy to implement
- fast and efficient process induction
- mercury-free
- environmentally friendly

The excimer advantage in industry deployment?

- eradicates unnecessary, time-consuming costs

Excimer technology eliminates the need for vacuum chambers, allowing users to fully focus on the inline process only. This is particularly efficient in large-volume testing facilities. Excimer technology also offers an instant on/off functionality. This reduces energy, cuts costs, and saves time, as users needn't wait until the lamp reaches its optimal temperature.

- drastically improves product quality

Excimer irradiation is particularly useful in a multitude of applications that require surface energy enhancement or a selective surface modification. It's also imperative for peculiar or special spectra requirements in the UV range. The enhanced surface energy secures a stronger adhesion of the material onto the surface and thus drastically improves product quality.

- optimizes overall process efficiency

Excimer ensures a high process stability and reliability over a long period of time. The homogeneous treatment is incredibly stable with no fluctuations in the process. As a result, no residue lingers, which secures a high surface energy and an optimal result.

The benefits of excimer light make the technology wildly popular in laboratory, semiconductor environments and many more custom applications.

The USHIO advantages

Extensive, ongoing R&D

We empirically understand how sometimes even the most infinitesimal modification can be of utmost importance to the optimization of any application. Develop, assess, evaluate, develop – customers can either send samples for testing in the USHIO specialized excimer laboratories all over the globe (Japan, Germany, US) or join the USHIO team on site for side-by-side exploration. The technology is R&D driven, the cooperation customer-focused. That's how USHIO solutions stay state-of-the-art.

Broad solutions range

USHIO has a solution to your need, regardless of its size. Small or big, we provide a broad range of various lamp lengths and outputs from 55mm and 9W up to 2200mm and 8,3kW. We also create complete radiation modules – a superior combination of excimer lamps and houses. And for those who want to go all-in, we design and create complete turnkey systems for entire processes (POC, in-room equipment, product, housing – you name it).

USHIO also insists on making the size of excimer modules as compact as possible to facilitate integration for each application. Sizes are adjusted to client needs and modules are readily available in a modular “building block” format.

Proven customer-driven success rate

The match between customer needs and the USHIO solution flexibility have established USHIO products as the preferred partner for applications, such as:

- surface activation
- removal of contaminants from production processes
- adhesion improvement
- optical bonding
- photochemical or biological processes



USHIO – over 5000 solutions - over 25 years of proven expertise accounts - over 90% excimer market share worldwide Our technology enables.

At USHIO, the whole truly is greater than the sum of its parts.

“Surface treatment success relies on precision. For Jaguar we need a particular process. We turned to USHIO for testing, technology and guidance. In 6 months’ time we were finally up and running. It would have taken us much longer without their help. Just the right tech at just the right timing in half the time. Outstanding service. Just ask Panasonic.”

– Mr. Christopher Peck Specialist Supervisor
Lamination Department at Panasonic

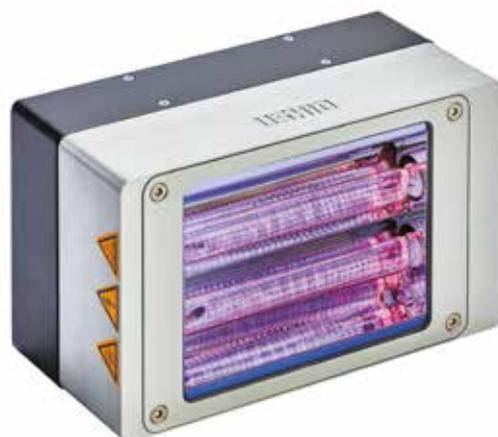
USHIO Excimer Solutions for laboratories

Small modules for testing and lab-scale application

Because little things can make big differences.

USHIO excimer technology offers a raft of benefits in a laboratory environment:

- the compact size ensures no external power supply is needed
- it's easy to integrate
- 24V only, allowing simple control and basic supervision
- USB control box is available
- the robust design for any type of testing
- air-cooled, with only small amount of N₂- purging required



Your USHIO selection:

Name/Type	Illumination window mm	Number of Lamps	Intensity mW/cm ² (Mean)	Intensity mW/cm ² (Max)
ExciJet172 25-85	85 x 60	1	10	23
ExciJet172 55-130	130 x 90	2	20	25



Gas and liquid irradiation

By irradiating gases and liquids, researchers can examine different spectral distributions.

By choosing an USHIO solution, you'll have access to:

- a complete system
- that comes in compact units
- and has water cooling available for the medium.

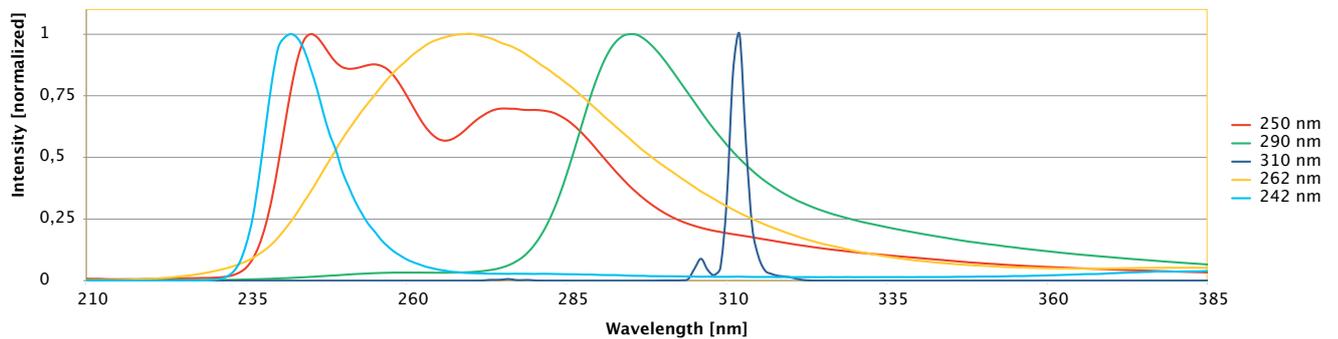
Your USHIO selection:

Name/Type	Illumination window mm	Number of Lamps
ExciJet172 reactor	130 length	1 Different wavelengths and types of reactors on demand.

Science happens when chemistry and timing collide.



Phosphor Excimer for spectra adaptation



Different phosphor excimer lamps allow the examination of different spectra. They are rapidly switchable, have long projected life-times and are compatible with dimmers. Their high functionality is only enhanced by extra benefits as they:

- facilitate both line spectra and broad distributions
- offer instant on-functionality
- come in a compact size
- run on an easy control system and power supply
- scalable up to 10 lamps

Your USHIO selection:

Name/Type	Illumination window mm	Number of Lamps	Intensity mW/cm ² (Mean)	Intensity mW/cm ² (Max)	Diameter mm
Lamps: different sizes and powers available	Standard: 100	---	Dependent on wavelength (from 2 to 10)	–	18
1-LAMP SYSTEM:	100x40	1 lamp	Dependent on wavelength (from 2 to 10)	2 - 10	18
2-LAMP SYSTEM	100x100	2 lamps (2 lamps can be either identical or with different phosphors)	Dependent on wavelength (from 2 to 10)	2 - 10	18

If you're not part of the solution, you're part of the precipitate.

Why rely on USHIO in your lab?

- high quality meets flexibility
- plug and play – small and compact makes for a flexible integration
- low power consumption makes it cost-saving
- safety-proof confirmed at all times
- industry endorsed by powerhouse institutions (i.e Fraunhofer Institute) and university cooperation
- no cure, no pay – rental test modules are available before implementation
- fair pay for fair play – market proof price/quality rate

“For the future roll-to-roll production of flexible solar cells, thin layers must be applied precisely onto the ITO foils. The USHIO Excimer module is an essential device to secure the proper adhesion of these layers by increasing the surface energy of the ITO material.”

M. Sc. Ludwig Pongratz – Project Manager
Micro and Nano Structuring, Fraunhofer-Institut
for Laser Technology

USHIO Excimer Solutions for industrial applications



Industrial applications are evolving at a rapid pace. USHIO recently developed this series combining high-power functionalities with the easiest of integrations, offering the market the highest flexibility at the best value/pricing ratio.

Your advantages:

- pure air cooling
- very high intensities (80mW/cm² continuous, up to 200mW/cm² pulsed)
- robust and compact design
- robotics or mobile installation options
- moderate N₂ consumption
- dimmable
- fully controllable via external signals or touch panel (optional)

OUR experience:

One size can fit all when it comes to large modules. This device is applicable for large size coatings and printing applications, as it has been optimized for integration in large volume protection modules. A cost-efficient time-saver that is finally available for all. A big must-have.

Your USHIO selection:

Name/Type	Illumination window mm	Number of lamps	Intensity mW/cm ² (Mean)	Intensity mW/cm ² (Max)
ExciJet172 400-200	200x130	2	60	80
ExciJet172 500-240	240x130	2	60	80
ExciJet172 750-340	340x130	2	60	80
ExciJet172 1500-640	640x130	2	60	80
ExciJet172 2000-750	750x130	2	60	80

USHIO Excimer Solutions for semiconductor applications



Our 80% market share demonstrates the strong position of our modules in this market. But that doesn't mean we rest on those laurels. The continuous improvement of the processing and cleaning of wafers with excimer radiation is our top priority to retain and gain market share.

Your advantages:

- clean-room compatible
- very high homogeneity and process stability
- highly supervised (each lamp is controlled by an individual UV-intensity sensor)
- fulfill semiconductor quality requirements
- optional advanced interface control and supervision (not all systems)
- easy integration into external control system, all relevant signals can be exchanged/monitored
- optimized for typical semiconductor sizes and applications

Your selection:

Name/Type	Illumination window mm	Number of Lamps	Intensity mW/cm ² (Mean)	Homogeneity	Application description inch
ExciJet172 CR	170	3	7	15%	6 Normal
ExciJet172 CR	230	4	7	15%	8 Normal
ExciJet172 CR	340	6	7	15%	12 Normal
ExciJet172 CR	170	2	50	10%	6 Middle
ExciJet172 CR	230	3	50	10%	8 Middle
ExciJet172 CR	340	4	50	10%	12 Middle

Different sizes and power are available on request.

USHIO Excimer Solutions for high-power scanning modules

High intensities require strong systems. USHIO systems are industry-validated as by far the strongest in the market. Our 80% plus market share substantiates that claim. They revolutionized the LED panel production by cleaning the panels at a speed of up to 300m/min, thus solving the problem of micro-contamination by black pixels.

Your advantages:

- extremely high VUV output (190mW/cm² and more)
- flexible module design (for each type 1, 2 or 3 lamps of the same width possible)
- wide range of sizes available up to 2600mm effective width
- high stability, special lamp design for good homogeneity and efficiency
- advanced power electronics with interface for external control and supervision
- complete control with touch panel available



Application TFT Monitor production.

Your USHIO selection:

Name	Lamp power	Illumination window mm	Number of lamps	Intensity mW/cm ² (Max)
ExiJet172 640-580	640Wx1	580x280	1	>170
ExciJet172 1280-580	640Wx2	580x280	2	> 170
ExciJet172 1920-580	640Wx3	580x420	3	> 170
ExciJet172 2400-820	800Wx3	820x420	2	> 170
ExciJet172 4890-1570	1630Wx3	1570x420	3	>170
ExciJet172 6000-1940	2000Wx3	1940x420	3	> 170
ExciJet172 8190-2730	2730Wx3	2670x420	3	> 170

USHIO Excimer customized solutions



One size rarely fits all.

USHIO offers its expertise of years at your service to make sure you get the solution you need.

- Our highly qualified development and production teams are at your disposal for an in-depth problem study, thorough research analysis, and extensive testing.
- An immaculate implementation after POC approval stresses the customer-driven focus of our team. When quality prevails, our team excels.
- Meticulous after-service secures a 100% satisfaction guarantee that design and solution exactly suit your requirements.

Our offering includes complete PLC and control systems, OEM turnkey solutions as well as integration into existing machineries. Cleanroom devices are also optional.

Your advantages:

- 100% needs fulfillment
- customised PLC and human interface to ensure quality requirements
- cleanroom compatible if required
- 100% process testing optimized
- flexible design for future-proof demand adaptations
- development in close customer cooperation
- With masks illumination of patterns possible, accuracy in the range of μm possible

Their USHIO experience:

“Sterilising medical instruments is of the utmost importance – every upgrade could save another life. To ensure consistent quality and do one better every time, we turn to reliable partners. Like USHIO. Our medical disinfection exchange with sterilisation rely on excimer technology for accuracy. The USHIO team provided us with multiple design proposals, which helped us make an informed decision on the best lamp selection to continuously move forward.”

Mr. Achille Othenin-Girard, Quality Assurance Manager at Sterilux SA

USHIO Excimer application laboratory

The Excimer Application Laboratory is a place of intensive in-house research, conceptualisation and design. The excimer lab enables Ushio to offer you a full package, total solution from consultation to product, and unparalleled excimer expertise all under one roof. We offer more than products. We offer purpose-driven solutions.

The USHIO procedure follows simple steps to secure optimal implementation

BEFORE

- research
- conceptualization
- in-house design
- extensive testing simulations

DURING

- applying 25 years of excimer expertise
- one-stop-shop partner
- impeccable quality prevails

POST

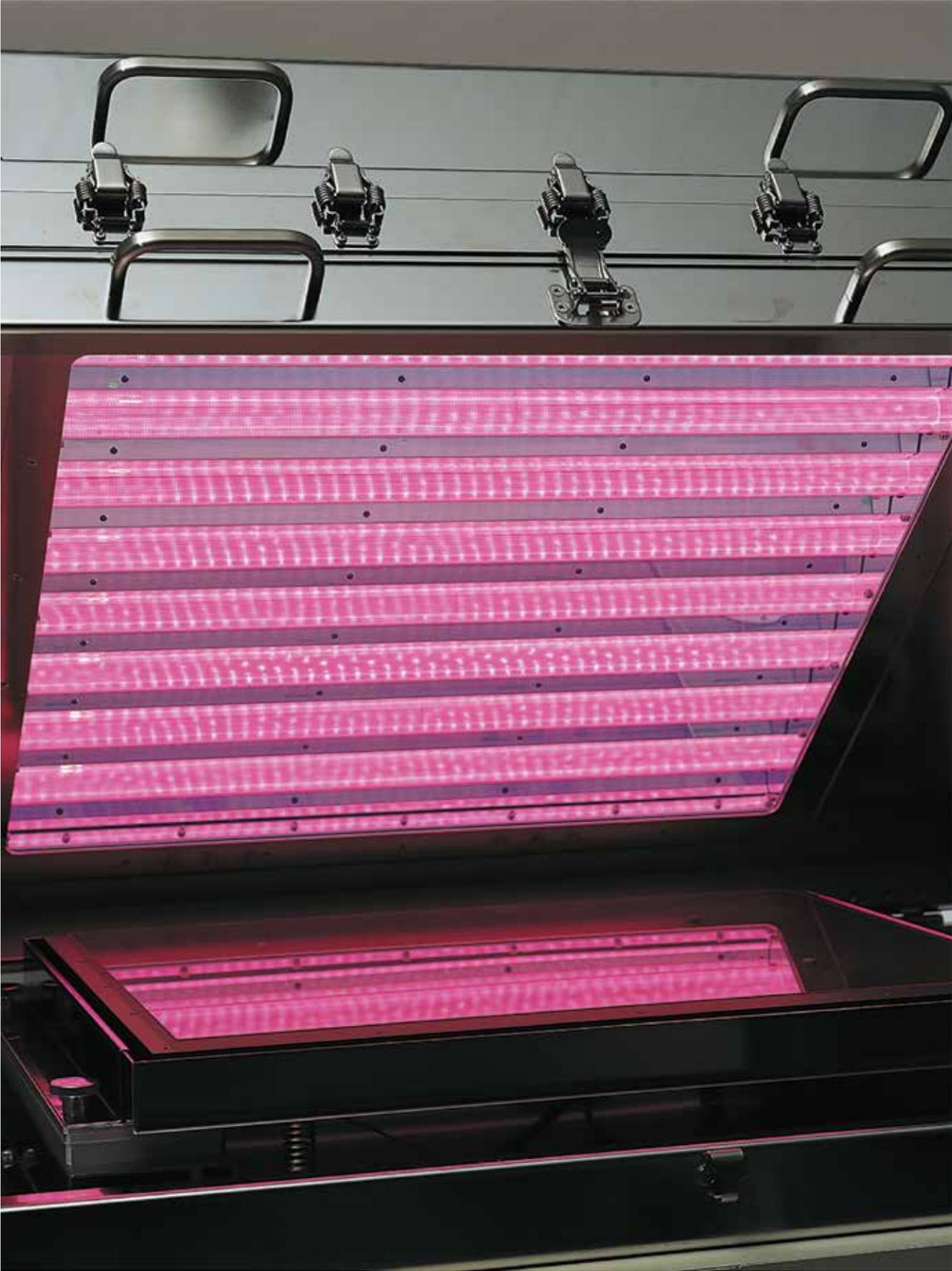
- test, measure, assess
- connect the dots, close the loop

95% of USHIO customers engaged in a test prior to quickly committing to the USHIO service. That's how we gained 90% market share.

Meticulous preparations, extensive measurement sequences and optimal service make USHIO your customer-driven technology partner of choice.

**FOR YOU. WITH YOU.
BY YOUR SIDE.**

USHIO technology enables.



Developing together with USHIO

Our special excimer irradiation has an enormous application potential for various materials and surfaces. USHIO is a partner that listens to your ideas and requirements. Let us optimize your processes according to your specifications and expectations. Use our expertise to develop together a tailor-made solution that matches your needs.



USHIO EUROPE B.V. - Headquarter

The Netherlands | Tel. +31 20 446 9333
info@ushio.eu | www.ushio.eu

USHIO DEUTSCHLAND GmbH

Germany | Tel. +49 8094 9054 0
info@ushio.eu | www.ushio.eu

USHIO U.K., Ltd.

United Kingdom | Tel. +44 1296 339988
info@ushio.eu | www.ushio.eu

USHIO FRANCE S.A.R.L.

France | Tel. +33 134 64 94 94
info@ushio.eu | www.ushio.eu