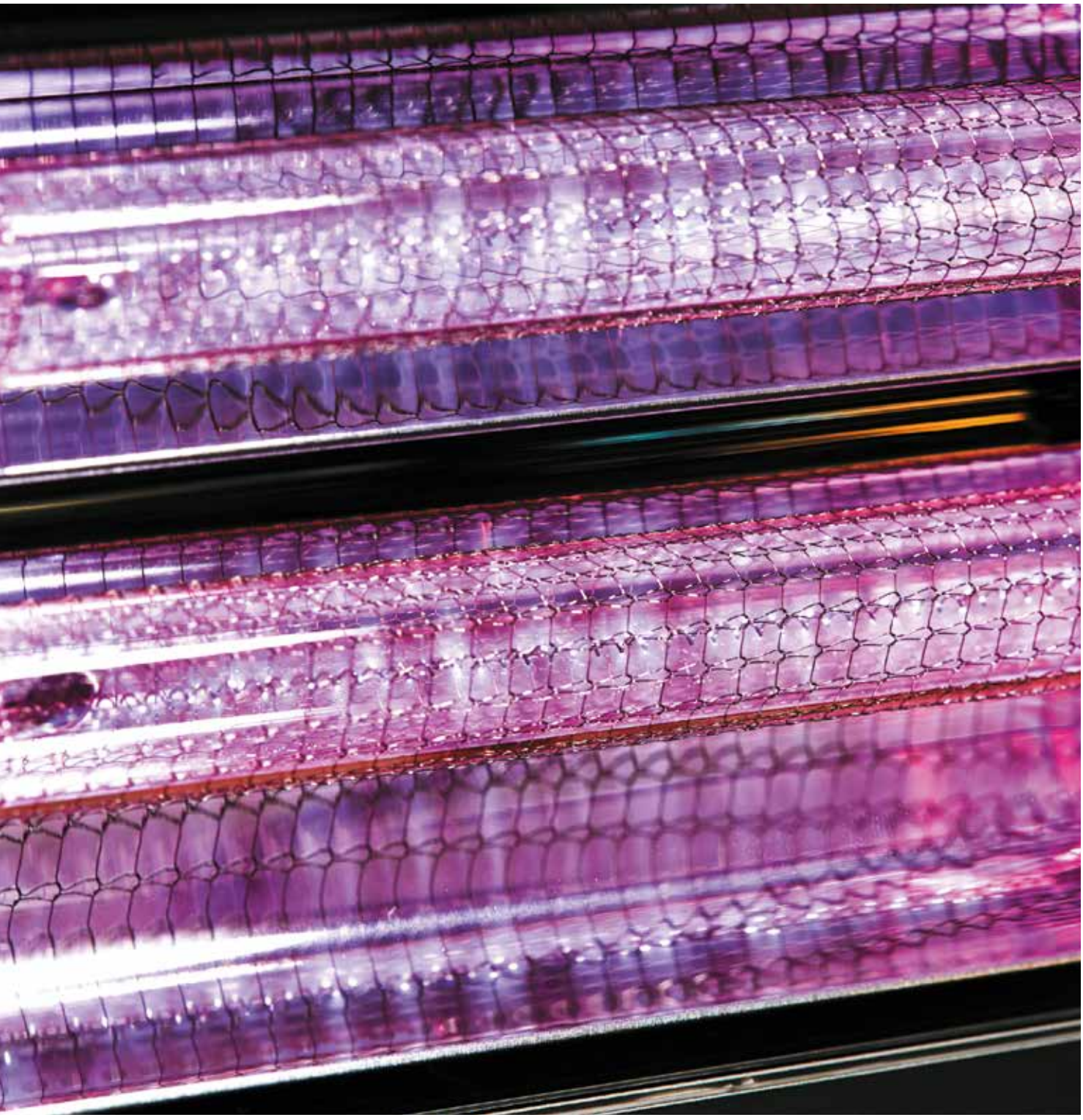
USHIO

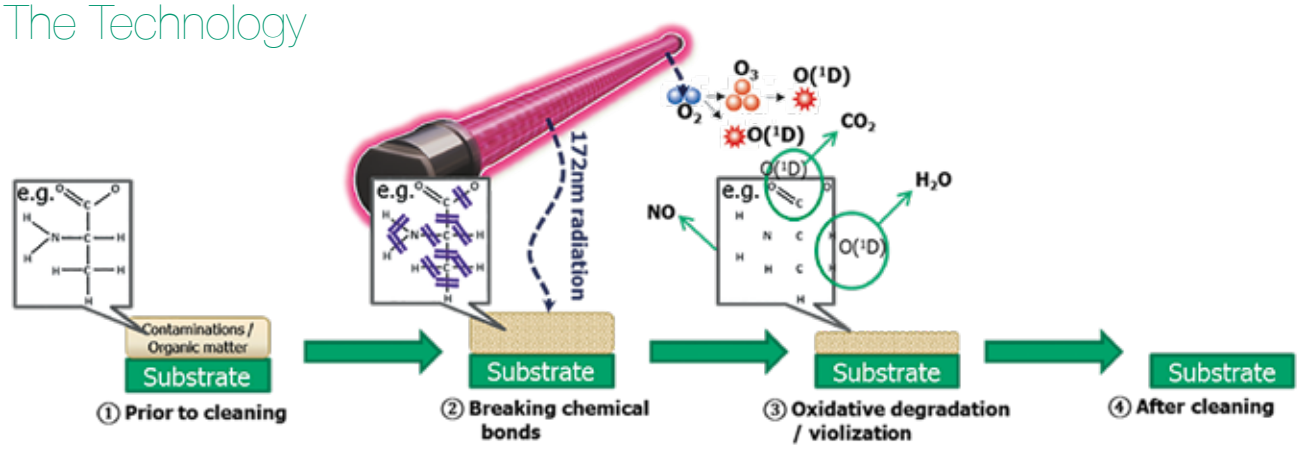
Excimer Irradiation Solutions

for laboratory and industrial applications



Excimer Irradiation

The Technology



The Excimer Principle

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

When high-energy electron pressure is applied from the outside onto a lamp filled with a noble gas or a noble gas halide compound, the lamp releases a discharge plasma (e.g. electric barrier discharge). This discharge plasma consists of high-energy electrons and disappears instantly. The discharge plasma does, however, excite the gas atoms inside to instantaneously produce an excimer state (for Xenon excimers: Xe_2^*). 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 Key Benefits Of Excimer Technology

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

The Excimer Advantage for Industry Development

- eradicates unnecessary, protracted costs

Excimer technology eliminates the need for vacuum chambers, allowing users to fully focus on the inline process. This especially enhances efficiency in large-volume testing facilities. Excimer technology also offers an instant on/off functionality. This reduces energy, cuts costs, and saves time, as the operator must no longer wait until the lamp reaches its optimal temperature.

- drastic improvement in product quality

Excimer irradiation is particularly useful in a multitude of applications that require surface energy enhancement, or surface activation. The irradiation pre-treatment secures a stronger bond with materials, such as inks, paints, and lacquers, while substantially improving product standards.

- optimisation of 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 excimer unit is also capable of peculiar or special spectra requirements in the UV range, with adjustable phosphor levels and the possibility to use several different modular calibrations.

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

The USHIO Advantage

Tirelessly Extensive Research & Development

We understand that even a minuscule modification can be of utmost importance to the optimization of any application. Develop, assess, evaluate, develop – customers can either send samples for testing at one of our specialized excimer laboratories across 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 is how USHIO solutions continue to define the current '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 – the only limitations are in your imagination).

USHIO also takes pride in making 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 contaminates from production processes
- adhesion improvement
- optical bonding
- photochemical or biological processes

At USHIO, the whole is truly 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

5000+ solutions

25+ years of proven expertise

95% of excimer market share

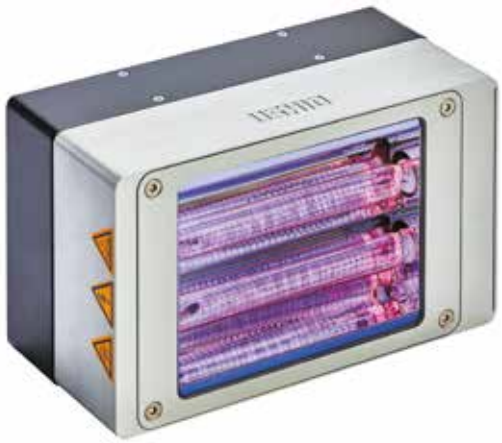
USHIO Excimer solutions for laboratories

Compact Modules For Testing & Lab-Scale Applications

Because small things can make a big difference.

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

- no external power supply required
- easy integration into existing systems
- 24V only, allowing simple control and minimal supervision
- robust design suited to all practical applications
- air-cooled, with limited N_2 purging necessary
- auxiliary USB control box extension available



Your USHIO Selection:

Name/Type	Illumination window mm	Number of Lamps	Intensity mW/cm²(Mean)	Intensity mW/cm²(Max)
ExciJet 25-85	85 x 60	1	10	23
ExciJet 55-130	130 x 90	2	20	25

Gas & Liquid Irradiation

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

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

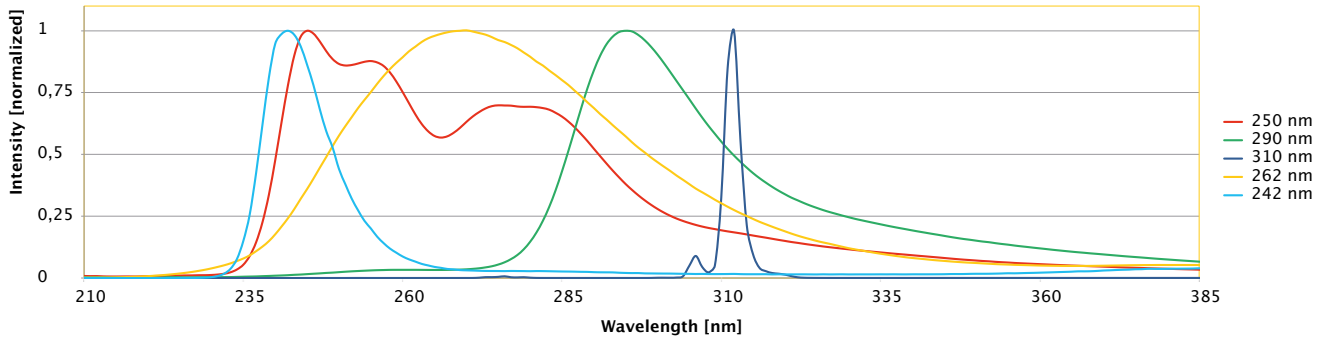
- delivered as a complete, compact system
- water cooling available for the medium
- customised wavelength control through phosphor-introduction

Your USHIO selection:

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

Science happens when chemistry and timing collide

Excimer Spectral Modification Possible Through Phosphor Introduction



Adjustable wavelengths through phosphor calibration allow the examination of different spectra. They are rapidly switchable, have long projected lifetimes and are compatible with dimmers. The functionality of the modules is enhanced by benefits such as:

- facilitation of line spectra *and* broad distributions
- instant on/off functionality without heating or cooling cycles
- compact size enables enhanced manoeuverability
- easy control system and built-in power supply
- scalability allows for potentially unlimited lamps & modules

Your USHIO selection:

Name/Type	Illumination window mm	Number of Lamps	Intensity mW/cm² (Mean)	Intensity mW/cm²(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

To ensure we find the solution to your needs, each excimer is unique

Why Bring USHIO Into Your Lab?

- high quality meets unprecedented customisation
- plug-and-play – compact & portable for a flexible integration
- low power consumption reduces excessive operation costs
- complete safety assured at all times
- endorsed by revered industry institutions, such as the Fraunhofer Institute, and tested with university cooperation
- full technical support from inquiry and testing phases, through to implementation & after-care
- best value for money – market proof price/quality ratio

"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 Institute for Laser Technology

USHIO Excimer solutions for industrial applications

Industrial applications for excimer continue to evolve at a rapid pace. USHIO recently developed a series combining high-power functionalities with the easiest of integrations, to offer the highest flexibility at the best value on the market.

Your Advantages:

- purely air-cooled
- very high intensities (80mW/cm² continuous, to 200mW/cm² pulsed)
- robust & compact design
- robotic or mobile installation options
- moderate N2 consumption
- dimmable
- fully controllable via external signals or touch panel (optional)

Our Experience:

One size fits all when it comes to large modules. These devices are applicable for large size coatings & printing applications, and are optimised for integration in large volume protection modules. A cost-efficient time-saver that is finally available for all.

We find that sticking to your choices can be undesirable when the situation changes. So we made sure that buying one module does not confine you to a set wavelength. Through the introduction of phosphors or by adjusting the noble gas inside the lamp, you can modify your required wavelength at a moments notice.

Your USHIO selection:

Name/Type	Illumination window mm	Number of lamps	Intensity mW/cm²(Mean)	Intensity mW/cm²(Max)
ExciJet 400-200	200x130	2	>50	>70
ExciJet 500-240	240x130	2	60	80
ExciJet 750-340	340x130	2	60	80
ExciJet 1500-640	640x130	2	60	80
ExciJet 2000-750	750x130	2	60	80

USHIO Excimer solutions for semiconductor applications

Our 95% market share demonstrates the level of quality our modules bring to the semiconductor market. But that does not mean we rest on our laurels. The continual improvement of the cleaning and processing of wafers, using excimer radiation, is our top priority. Through this commitment, we are sure to continue gaining further market share in the future.

Your advantages:

- clean-room compatible
- consistently high homogeneity and stability
- each lamp is controlled by an individual UV-intensity sensor
- fulfil semiconductor quality requirements
- advanced interface control and supervision (optional, not all systems)
- easily integrated into existing control systems, allowing the monitoring and exchange of all relevant signals
- optimised for conventional semiconductor sizes and applications

Your USHIO selection:

Name/Type	Illumination window mm	Number of Lamps	Intensity mW/cm²(Mean)	Homogeneity	Application description inch
ExciJet CR	170	3	7	15%	6 Normal
ExciJet CR	230	4	7	15%	8 Normal
ExciJet CR	340	6	7	15%	12 Normal
ExciJet CR	170	2	40	10%	6 Middle
ExciJet CR	230	3	40	10%	8 Middle
ExciJet CR	340	4	40	10%	12 Middle

Different sizes and power calibrations are available on request

USHIO Excimer solutions for high-power scanning modules

High intensities require strong systems. USHIO systems are the strongest in the market, as testified by the industry leaders themselves. And our market share of over 95% clearly substantiates that claim. USHIO Excimer has revolutionised the production of LED panels, by cleaning them at a speed of up to 300m/min, thus solving the problem of black pixel micro-contamination.

Your advantages:

- extremely high VUV output (170mW/cm² and higher)
- flexible module capacity
- wide range of sizes available (up to 2600mm effective width)
- high stability, designed specifically for high homogeneity and efficiency
- advanced power electronics, external control, and supervision interface
- touch panel control available (optional)

Application to TFT Monitor production

Your USHIO selection:

Name	Lamp power	Illumination window mm	Number of lamps	Intensity mW/cm²
ExciJet 640-580	640Wx1	580x280	1	>170
ExciJet 1280-580	640Wx2	580x280	2	>170
ExciJet 1920-580	640Wx3	580x420	3	>170
ExciJet 2400-820	800Wx3	820x420	2	>170
ExciJet 4890-1570	1630Wx3	1570x420	3	>170
ExciJet 6000-1940	2000Wx3	1940x420	3	>170
ExciJet 8190-2730	2730Wx3	2670x420	3	>170

USHIO Excimer customised solutions

Expertly Crafted To Your Specifications

USHIO offers its expertise of almost 30 years, to make sure you get the tailor-made solution that 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. Where quality prevails, our team excels.
- Meticulous after-service secures a 100% satisfaction guarantee, that ensures our design & solution are delivered to your exact requirements.

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

Your advantages:

- All agreed requirements will be fulfilled 100%
- customised PLC and human interface to ensure high quality standards
- cleanroom compatible
- 100% process testing optimized
- flexible design for future-proof demand adaptations
- close customer cooperation in development & customisation stage
- masks allow illumination of patterns, 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

Excimer Innovation Laboratory for research & development

The Excimer Innovation Laboratory is a place of intensive in-house research, conceptualisation and design. The excimer lab enables USHIO to formulate a bespoke package, by utilising our in-house excimer expertise and guiding you to the perfect solution. We offer more than products, we offer purpose-built solutions. From consultation to delivery, we listen to your needs and use our professional experience to make them happen.

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

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

The USHIO application procedure follows simple steps to secure optimal implementation

BEFORE

- research
- cooperative conceptualisation
- in-house design and recommendations
- extensive testing simulations

DURING

- applying over 25 years of excimer expertise
- one-stop-shop partner available to make adjustments
- uninterrupted focus on impeccable quality

AFTER

- test, measure, assess
- remaining available for questions and maintenance
- alterations, performance analysis
- we connect the dots, close the loop

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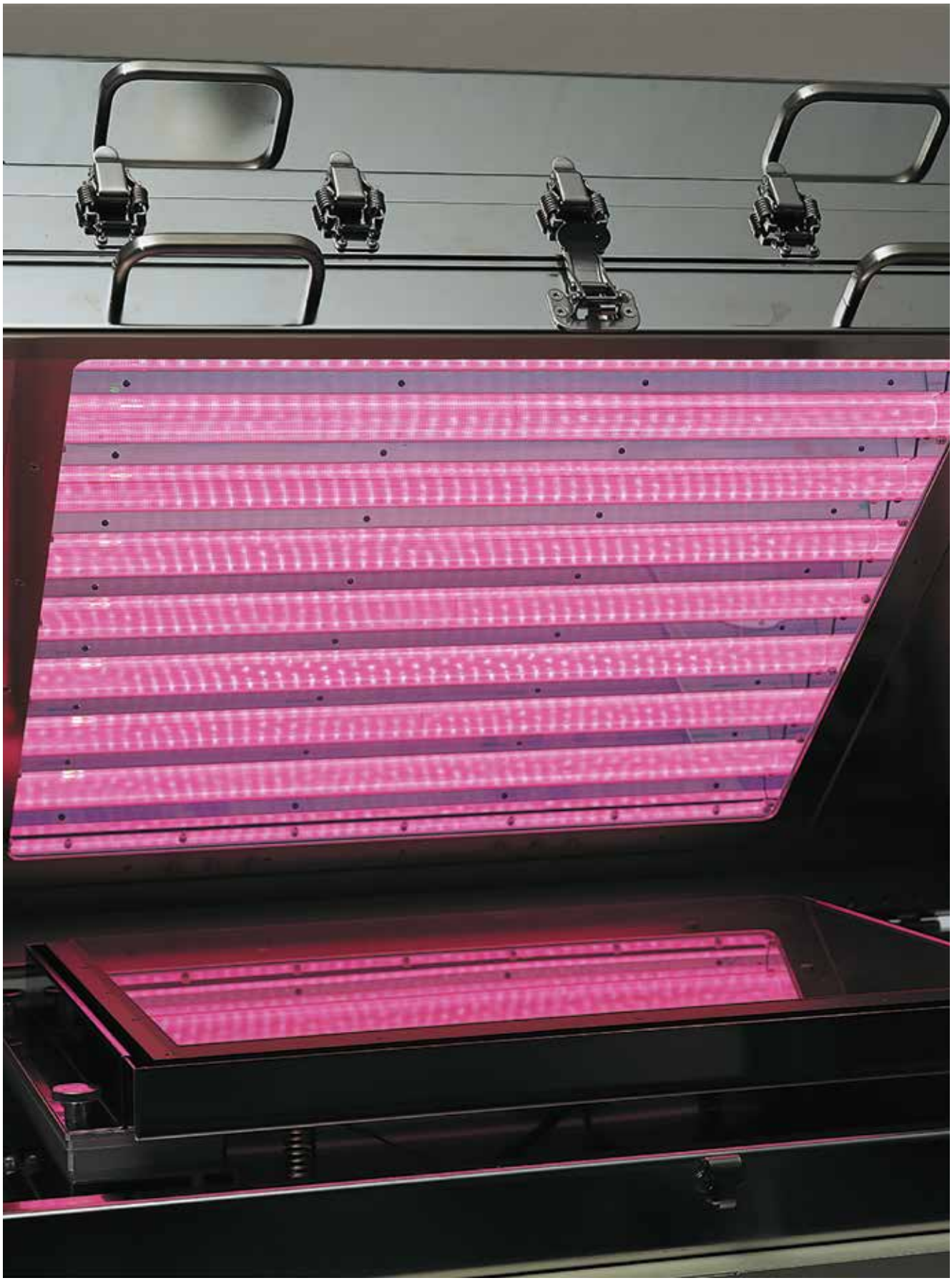
Bring Light to Life



Developing together with USHIO

Our special excimer irradiation has enormous application potential for various materials and surfaces. USHIO is a partner that listens to your ideas and requirements. Let us optimise 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. - Headquarters
The Netherlands | Tel. +31 20 446 9333
info@ushio.eu | www.ushio.eu

USHIO U.K., Ltd.
United Kingdom | Tel. +44 1296 339988
info@ushio.eu | www.ushio.eu

USHIO DEUTSCHLAND GmbH
Germany | Tel. +49 8094 9054 0
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

Version: 1903-B-UV-EXCI-EN