

Technology for UV-Polymerization

Company and Products

Pioneers of UV Technology

Dr. Karl Przybilla, physicist and expert in discharge lamps, set up his own business in the early 1970s to supply the first specialized UV lamps for technical applications in Europe. At the time, this opened up new fields of application for the powerful UV lamps developed and produced by Dr. Przybilla at Ultralight AG, which he had founded in Liechtenstein. The present company **uviterno** was founded in 1986. Dr. Przybilla and his Ultralight AG maintained a friendly and business relationship with our three founders. Over the years, Dr. Przybilla acquired all shares from the original shareholders. When his son Dr. Karl Przybilla jun., who likewise holds a PhD in physics, joined the management in 2006, the story came full circle.



Specialists in UV Polymerization

With more than 35 years of experience, **uviterno** is an established supplier in the market. Whether classic UV systems based on Hg lamps, complete machines or tailor-made solutions – the leading printing press manufacturers worldwide rely on **uviterno**'s experience and the quality of their products. As a supplement to conventional UV

technology, **uviterno** offers UV-LEDs that have been developed to market maturity and can be used for a significantly expanded range of applications. Though UV LEDs will not replace Hg lamps in the near future, they will enable completely new applications.

Evolution through Experience

As long-standing suppliers of UV technology, we know what our customers expect from us – in addition to reliable products and excellent service, they want openness to new technical requirements. As a pioneer of UV technology with our own development department, we want to deliver sustainable and high-quality products. Our products therefore contain the knowledge and experience we have gained from many years of collaborating with our customers. A product portfolio of standardized UV components has grown out of this long period of successful cooperation

and is now in use by thousands around the world. **uviterno** is characterized by fast decision-making processes and flexible production. We are neither a manufacturer of special machines nor do we rely exclusively on standard products. Instead, we combine the best of both worlds – achieving a high level of standardization while allowing for a wide range of options and customer-specific adaptations in our products. We will continue to pursue this strategy and look forward to solving the challenges of the future together with our customers through innovation.

UV Interdeck Curing (Label Printing)



Fig. **uviterno** SRK units; temperature-sensitive application when printing on thin films.

Final Curing of Direct Print Cups



Fig. **uviterno** SRK Cup-Line in a high-speed cup printing machine.

3D Curing of Coated Injection Molded Parts

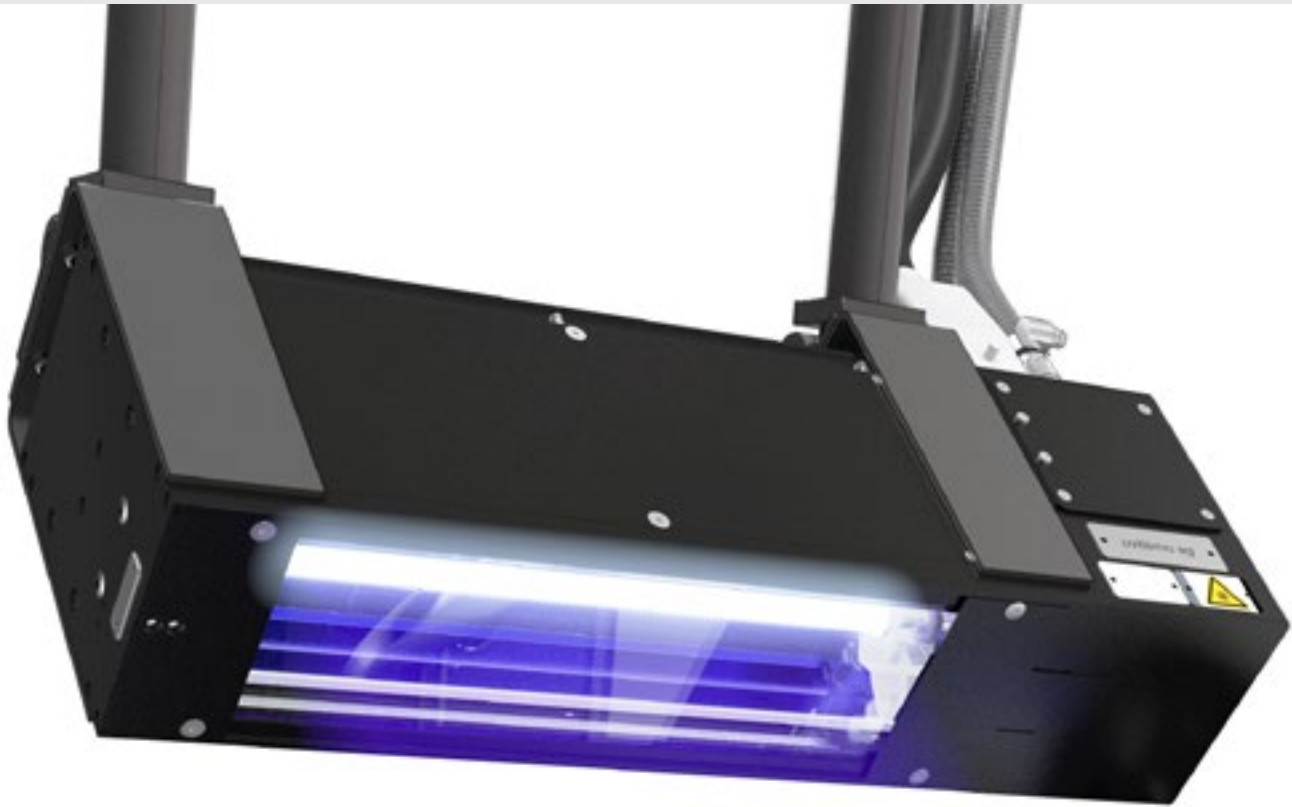


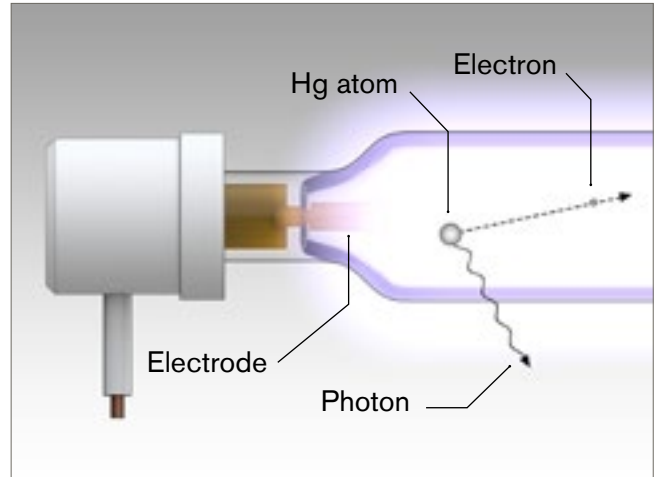
Fig. uviterno ACS units in a protective coating application for metalized plastic injection molded parts.



Hg Lamp – Structure and Components

UV Generation with Hg Lamps

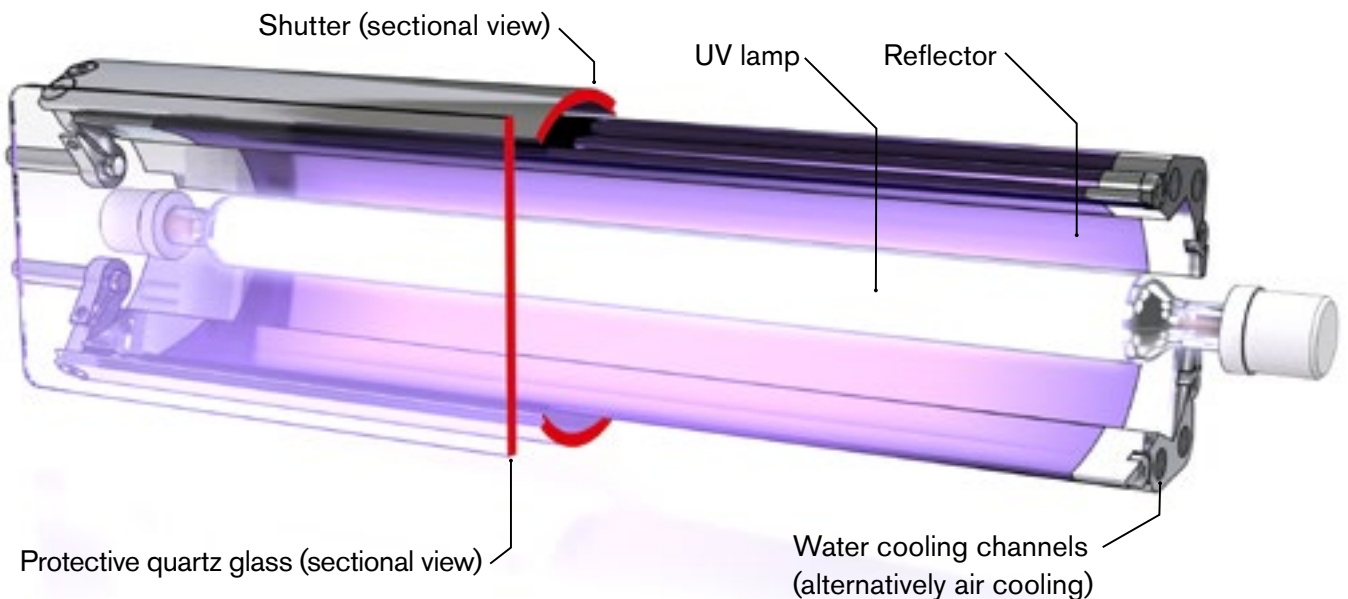
A heat-resistant quartz glass bulb contains a small amount of mercury as well as argon, which supports the ignition process. A high voltage is applied to the electrodes located in the lamp base. The electric field accelerates free electrons, which release further electrons and ions via impact ionization with the gas atoms. As the temperature inside the glass bulb rises, the mercury vaporizes and forms a plasma, which emits a characteristic line spectrum. Radially emitted light is focused by reflectors in the direction of the substrate. Active cooling dissipates the excessive heat.



Components of the UV Module

The UV light emitted by the arc lamp is projected onto the object plane with high efficiency by coated reflectors. For heat-sensitive substrates, special coatings can additionally reduce the IR portion of the radiation. Quartz plates isolate the internal components from the process environment and thereby enable longer service lives. Optional

special coatings on the quartz plates can further increase efficiency and further reduce the transmitted IR radiation. Shutters are used to seal off light and heat in standby mode and, at the same time, ensure immediate process readiness when the irradiation process is resumed.



Hg Lamp – Reflectors

Reflector Function

Reflectors increase the efficiency of a module. Without a reflector, only about 20% of the radiation would reach the substrate. Because a considerable proportion of the emitted spectrum is in the infrared range, this mostly leads to an undesired heating of the substrate. This can be minimized via specially coated mirror surfaces that reflect only the short-wave UV component and absorb the long-wave IR component. The thermal energy absorbed by the reflector is removed by forced cooling.

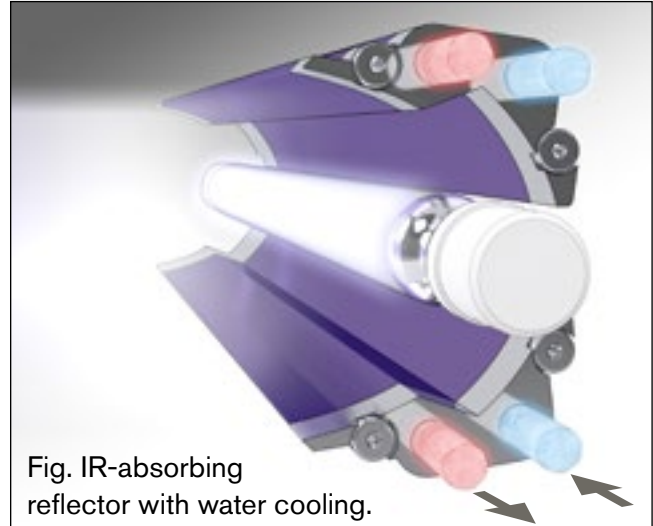
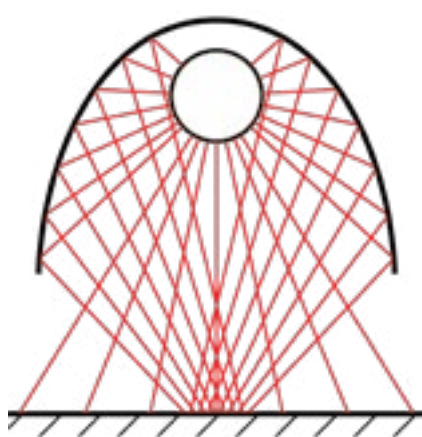


Fig. IR-absorbing reflector with water cooling.

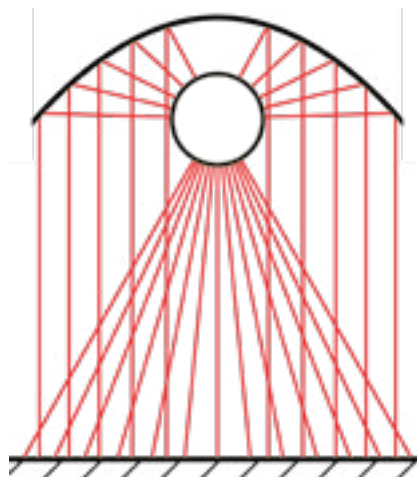
Reflector Geometry

The geometry of the reflector determines the radiation pattern on the substrate. Whether focusing a high output onto a small surface or an even distribution onto a larger surface – the choice of reflector has a decisive influence. There are three main reflector geometries: flat, parabolic and elliptical. Often, reflectors comprise a combination of these three basic types and are either made of specially coated aluminum profiles or quartz glass.

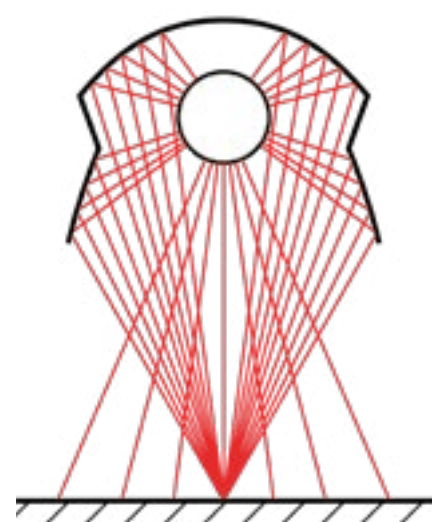
uviterno has years of experience in calculating the optimal geometry for a wide range of industrial UV applications. The operating limits of an application can be significantly expanded by applying optimal reflector geometry.



Elliptical



Parabolic



Double elliptical

UV Modules with Hg Lamps

DSK

The DSK is a very frequently used UV module from **uviterno**. Its compact design, in combination with an output of 200 W/cm, opens up a wide range of applications, especially where space is limited. The temperature and power-controlled air-cooling system can function either as a completely closed system that does not interact with the irradiation

zone or by drawing in filtered cooling air from the rear area and extracting it via a hose. The module is equipped with a shutter and optionally available with a water-assisted cooling system for particularly sensitive substrates. The DSK is available in three different radiation lengths.

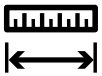
Technology



air



200 [W/cm]



150, 250 or 350 [mm]
adapted lengths on request



w	h	l	[mm]
92	120	360 - 572	



position - front / side / top

Typical Applications

- + 3D printing machines
- + curing of varnishes and inks
- + «low migration» inks



Fig. **uviterno** DSK with 250 mm lamp.

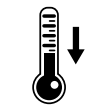
UV Modules with Hg Lamps

ACS – Air Closed System

The ACS is purely water-cooled, which means that ambient air is neither supplied nor extracted. The lamp and reflectors are thereby optimally protected against ink mist from printing units. This concept allows for very high performance in a compact design. In situations where air cooling is not possible nor desirable, the ACS can play

to its strengths. For instance, it is often used in air-conditioned rooms or clean rooms. The low space requirements of the ACS make it ideal for use in very compact machines, where air cooling is problematic or impossible due to lack of space. The ACS is equipped with a shutter and is also available in special lengths.

Technology



water



200 [W/cm]



150 - 550 [mm]



w	h	l	[mm]
100	140	344 - 744	



position – front / side / top

Typical Applications

- + glass printing machines
- + plastic tube printing
- + headlamp coating
- + finishing lines
- + lab and clean room applications



Fig. uviterno ACS with 200 mm lamp.

UV Modules with Hg Lamps

SRK Cup-Line

The SRK Cup-Line is a compact, high-performance radiation head. The optics are energetically optimized so that the radiation yield is increased by 40% compared to similar heads. The Cup-Line is air-cooled, whereby the cooling air leaves the head via the radiation window. The pneumatically driven shutter can immediately stop the beam in

case of process interruptions. In clocked operation, very high outputs of up to 500 W/cm can be achieved. The SRK Cup-Line is therefore the ideal UV module for very fast carousels, such as cup and bucket printing machines or machines with particularly high performance requirements.

Technology



air



330 (clocked: 500) [W/cm]



150, 200 or 250 [mm]



w	h	l	[mm]
114	92	450 - 550	

Typical Applications

- + cup and bucket printing machines
- + fast carousels
- + special-purpose machines

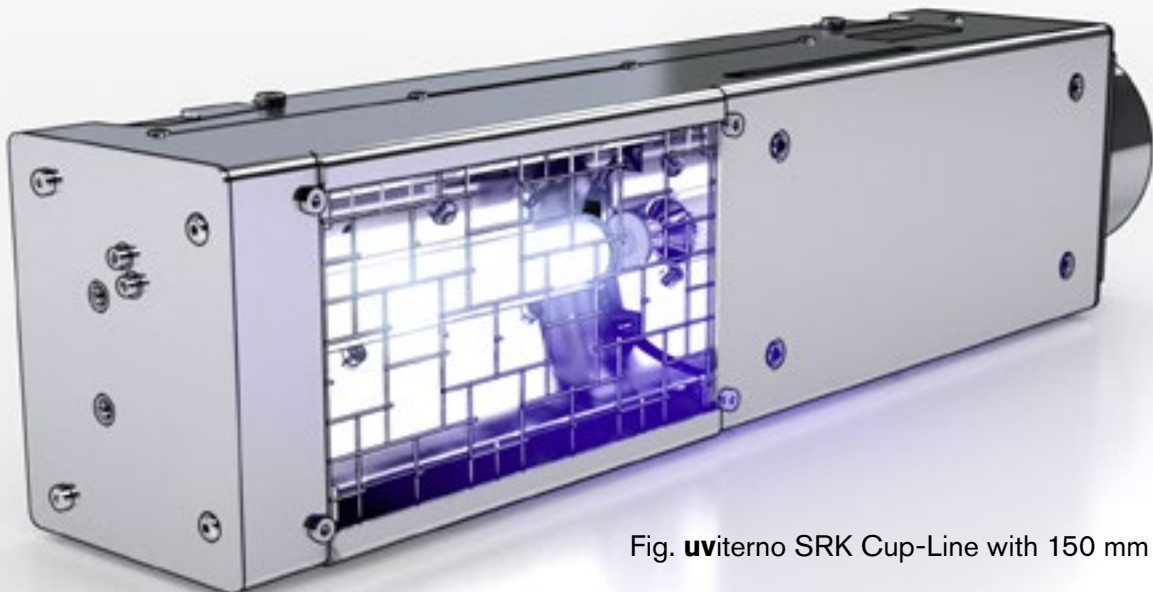


Fig. uviterno SRK Cup-Line with 150 mm lamp.

UV Modules with Hg Lamps

DSK Web-Line

The DSK Web-Line is air-cooled in the basic version. Hybrid operation in the Pro version combines the advantages of air cooling with water cooling and thereby achieves high performance with low cooling air requirements. Its slim design and practical slide-in system makes it ideal for use in modern printing presses (where space

is at a premium) and allows for convenient and cost-effective maintenance. The DSK Web-Line is available with various arc lengths and options, e.g. with specially coated reflectors and quartz plates to reduce substrate temperature.

Technology



air (Basic) or hybrid (Pro)



140 (Basic) / 200 (Pro) [W/cm]



150 - 550 [mm]



w	h	l	[mm]
100	140	443 - 843	

Typical Applications

- + label printing machines
- + curing of varnishes and adhesives
- + «low migration» inks

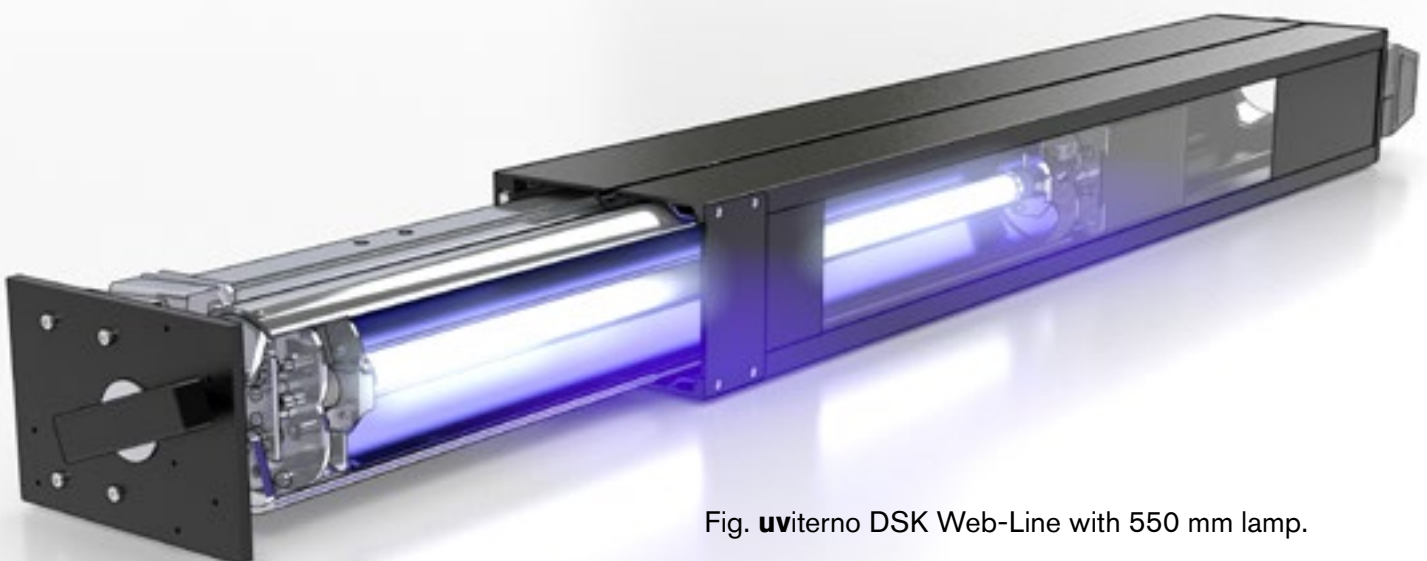


Fig. uviterno DSK Web-Line with 550 mm lamp.

UV Modules with Hg Lamps

STK

Some applications in the field of UV curing have demanding requirements: high performance, compact designs, low weight and a construction that is insensitive to disturbances and external influences. The STK meets all these requirements. Cooling air is blown out through the radiation window, which maintains the necessary process heat

for various ink and varnish systems. Shutter and quartz plate are not included in the design to save weight. This facilitates integration into robotic and automation systems while thermal monitoring and control guarantees optimum operating conditions and ensures technical process quality.

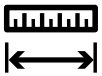
Technology



air



200 - 120 [W/cm]



150 - 450 [mm]



w	h	l	[mm]
106	92	342 - 642	

Typical Applications

- + inks, varnishes and adhesives
- + portal curing in finishing lines
- + robotic integrations
- + powder coating



Fig. uviterno STK with 250 mm lamp.

UV Modules with Hg Lamps

SRK Coldstar

UV curing of printing inks on label material with plastic substrates is considered particularly demanding. On the one hand, there are the high printing and transport speeds of the printing press. The resulting short processing time of the substrate under the light source requires comparatively high UV irradiation power. On the other hand,

plastic-based substrates and carrier materials are becoming thinner and thinner and therefore more temperature-sensitive. The SRK Coldstar solves the problem by providing a cool air cushion which extracts heat from the label material. The air cushion is generated by a combination of water cooler and fan.

Technology



water



200 [W/cm]



300 [mm]



w	h	l	[mm]
247	507	560	

Typical Applications

- + label printing machines
- + thin foils
- + heat-sensitive laminates
- + plastic labels

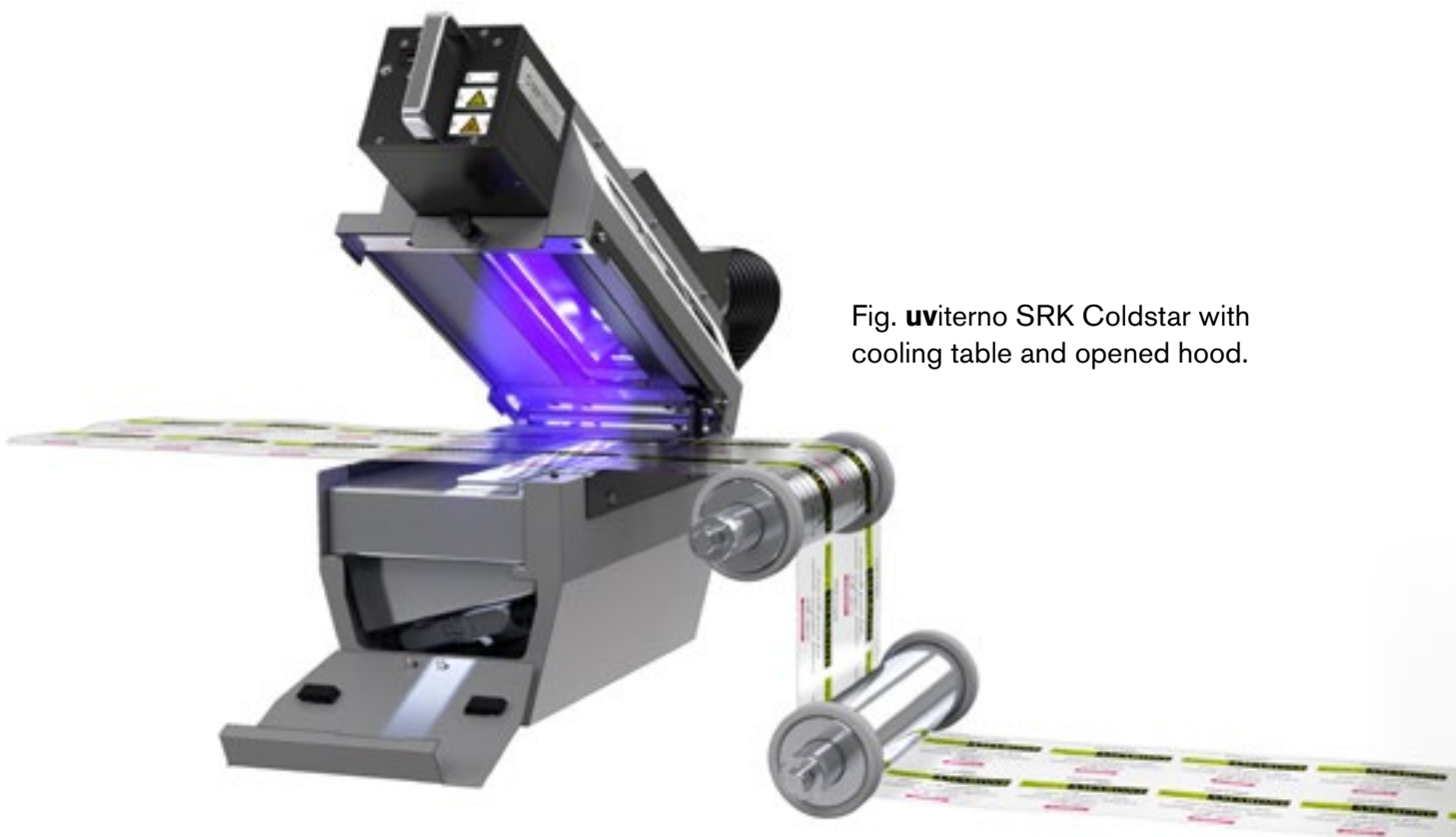


Fig. uviterno SRK Coldstar with cooling table and opened hood.

UV LEDs – Basics, Properties and Advantages

UV Generation with LEDs

Recent advances in semiconductor manufacturing have led to an impressive increase in the luminous efficacy of LEDs, which is why LEDs are becoming increasingly common in industrial applications. LEDs (light emitting diodes) are essentially pn semiconductor diodes which are operated in the forward direction and emit monochromatic radiation of a characteristic wavelength. The wavelength depends on the composition of the semiconductor layers. Currently, LED chips with wavelengths in the UV-A range (UV-A: 315-380 nm) or the shortwave segment of the visible spectrum are mainly used for industrial UV applications. The most prominent types are 365 nm, 385 nm, 395 nm, and 405 nm. These LED chips have been available on the market for quite some time with very good efficiency and service life spans, as well as acceptable costs.

However, the luminous efficacy of the most efficient LEDs today is still well below 50%. This means that considerable heat (more than 50% of the supplied electrical power) is generated in the semiconductor crystal – a very small space. It is of the utmost importance for the longevity of LEDs that these heat losses are efficiently dissipated. For densely packed LEDs, the cooling

principle is therefore the decisive factor. Water cooling enables maximum irradiance with minimum installation sizes. Air cooling is also possible for small to medium irradiance levels, but this leads to larger structures and makes them more difficult to install.

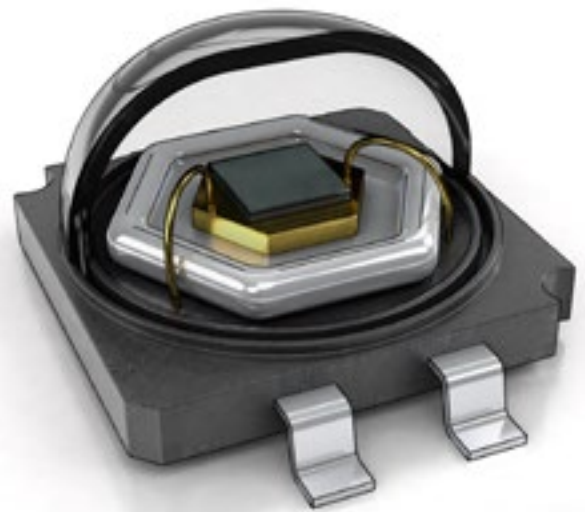


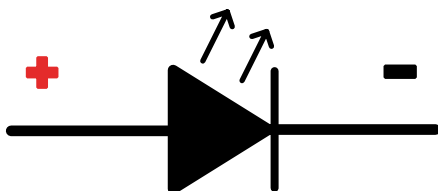
Fig. SMD LED: The chip, with 2 bond wires on a substrate, with a heat sink beneath; the lens is cut open for better viewing.

The Semiconductor

Because UV LEDs consist of semiconductor components, they can be switched on and off very quickly using electronic circuits.

This enables both dimming and switching operations, depending on the desired application. At the same time, the service life of UV LEDs extends

well beyond 10,000 operating hours, without any noticeable wear due to switching cycles. Like other semiconductor devices, LEDs do not emit any toxic substances.



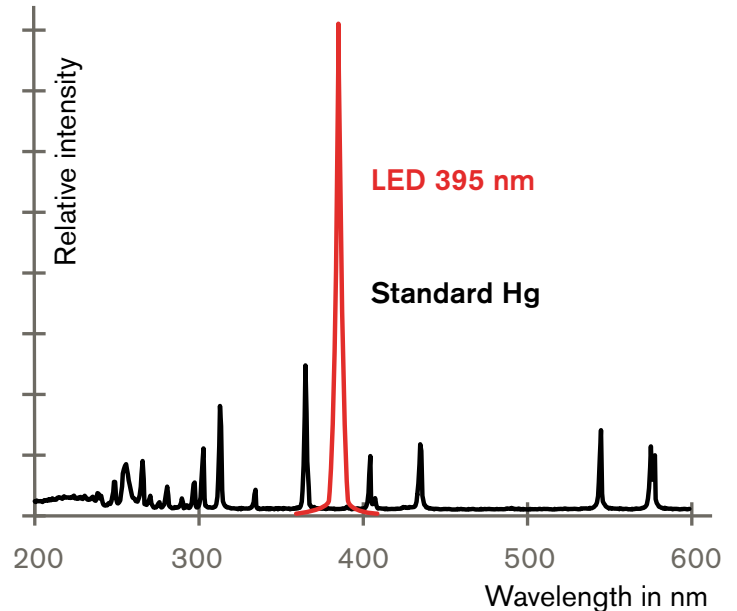
- + instant on/off possible
- + virtually no wear and tear
- + toxic-free operation

UV LEDs – Basics, Properties and Advantages

Discrete Spectrum

The spectrum of UV LEDs depends on the choice of semiconductor materials. In contrast to the Hg lamp, the LED emits only one main line at a time, but this line is very intense.

Depending on the semiconductor selected, 365nm, 385nm, 395nm or 405nm wavelengths are currently possible. There is no emission in the infrared range, which protects the substrate. Moreover, nothing is emitted in the extremely short wavelength range below 240nm, which prevents ozone formation. Due to the relatively narrow spectrum, the ink/varnish system should be tested and adjusted to the relevant range.



- + **no ozone emissions**
- + **no IR component in the spectrum**
- + **high efficiency in the emitted line**

Mechanical Construction Method

In UV LED systems, many individual LEDs are combined to form clusters. Each cluster is powered by its own power electronics. As a result, modules can be offered in almost any dimensions. Because no toxic ozone is produced during operation above 240nm, no extraction is required. Top-mounted lenses not only protect the LEDs, but also allow the radiation characteristics to be influenced. UV LEDs do not require shutters, enabling the design of very compact and versatile units.

- + **compact machines possible**
- + **flexible installation options**

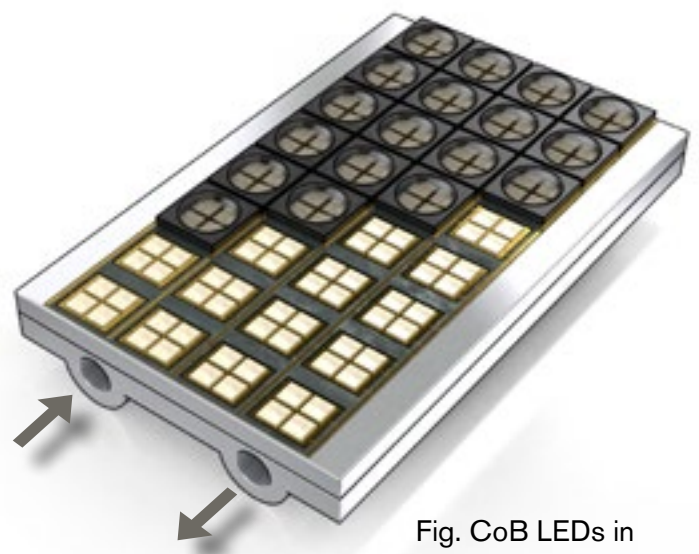


Fig. CoB LEDs in cluster design with water cooling.

UV Modules with LEDs

LED Modules

The LED modules from **uviterno** use state-of-the-art UV LED technology. All the advantages of LEDs over mercury lamps apply here.

The water-cooled standard modules have a cross-section of only 84 x 108 millimeters and are offered by **uviterno** in length increments of 60 millimeters. This allows machines to be built very

flexibly and compactly. The ability to switch on and off at will offers completely new possibilities for discontinuous processes. Movable components, such as shutters, become superfluous. The water cooling also minimizes the wear and tear of the LEDs, which is an invaluable advantage for maintenance and service life.

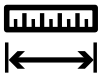
Technology



water



on request



60 - 1620 [mm]



w	h	l	[mm]
84	108	160 - 1720	



365 / 385 / 395 / 405 [nm]

Typical Applications

- + discontinuous processes
- + super-compact spaces
- + maintenance-free applications
- + LED spectrum sensitive inks

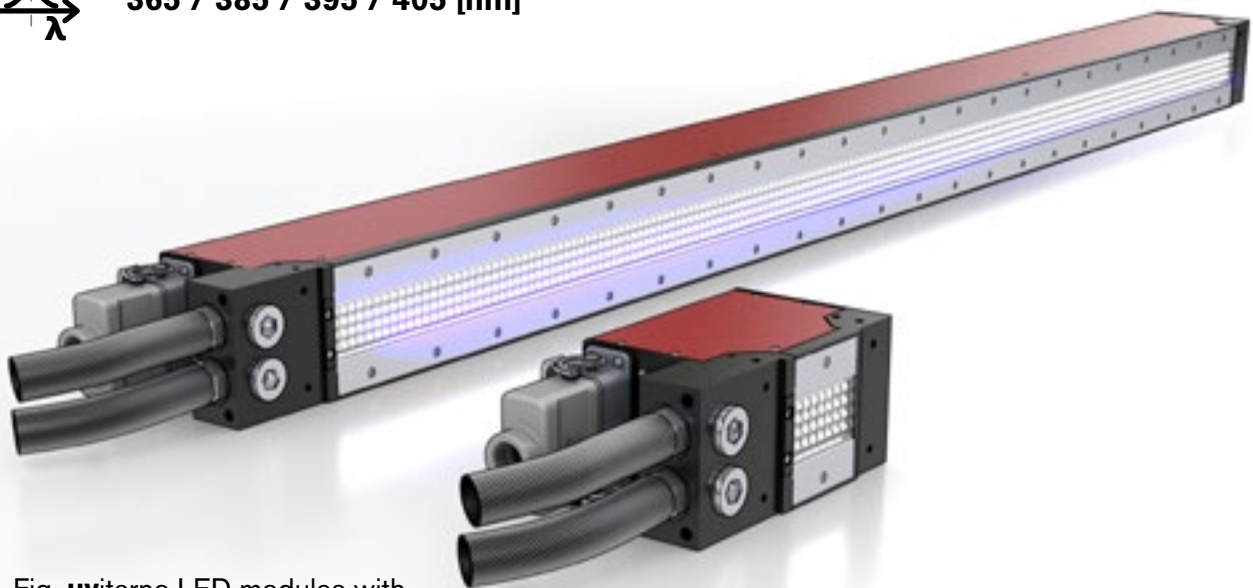


Fig. **uviterno** LED modules with 60 mm and 1320 mm emission windows.

Complete Machines

BT-B – Belt Curing Oven for Molded Parts

Efficient curing, variable product geometries and flexible application possibilities characterize the belt curing oven BT-B. Practical functions, such as height adjustment, maintenance flaps and the possibility of folding up the entire curing tunnel, give the BT-B a wide range of applications while simplifying maintenance. The non-slip vacuum belt

holds even low-weight molded parts securely on the belt. The two UV beam heads, each with an arc length of 450 mm, cure the products quickly and evenly. Finally, a cooling air extraction system for ink fumes and ozone makes the BT-B a safe and clean solution.

Technology

- + belt speed 25 to 75 [m/min]
- + two UV lamps with 4 [kW] each
- + max. width of the parts 140 [mm]
- + max. height of the parts 120 [mm]
- + dimensions 804 x 1264 x 2700 [mm]
- + several variants available

Typical Applications

- + hollow bodies (cups, lids)
- + glass, aluminum and decorative articles
- + coated 3D parts
- + various versions as laboratory devices



Fig. uviterno BT-B with open doors and opened curing tunnel.

UTUK G3 – Chain Curing Oven

The proven chain curing system from **uviterno** is now in its third generation and provides a safe solution for curing cylindrical hollow bodies that are conveyed by chain on the production side. The UTUK can be easily integrated into production processes. The mechanics of the chain guide ensure that the products are evenly exposed as they

travel through a radiation tunnel equipped with two UV lamps. The chain can enter and exit from the side or the bottom. Thanks to the robust thermal management and UV modules that move to parking positions when the chain stops, the system can even cure very sensitive products.

Technology

- + drive-free chain guide
- + two UV lamps with 4 [kW] each
- + max. Ø of the parts 60 [mm]
- + max. radiation width 300 [mm]
- + dimensions 1144 x 846 x 986 [mm]
- + chain entry/exit at side or bottom
- + adjustable chain pitch

Typical Applications

- + plastic tubes
- + bottle caps
- + plastic and aluminum sleeves

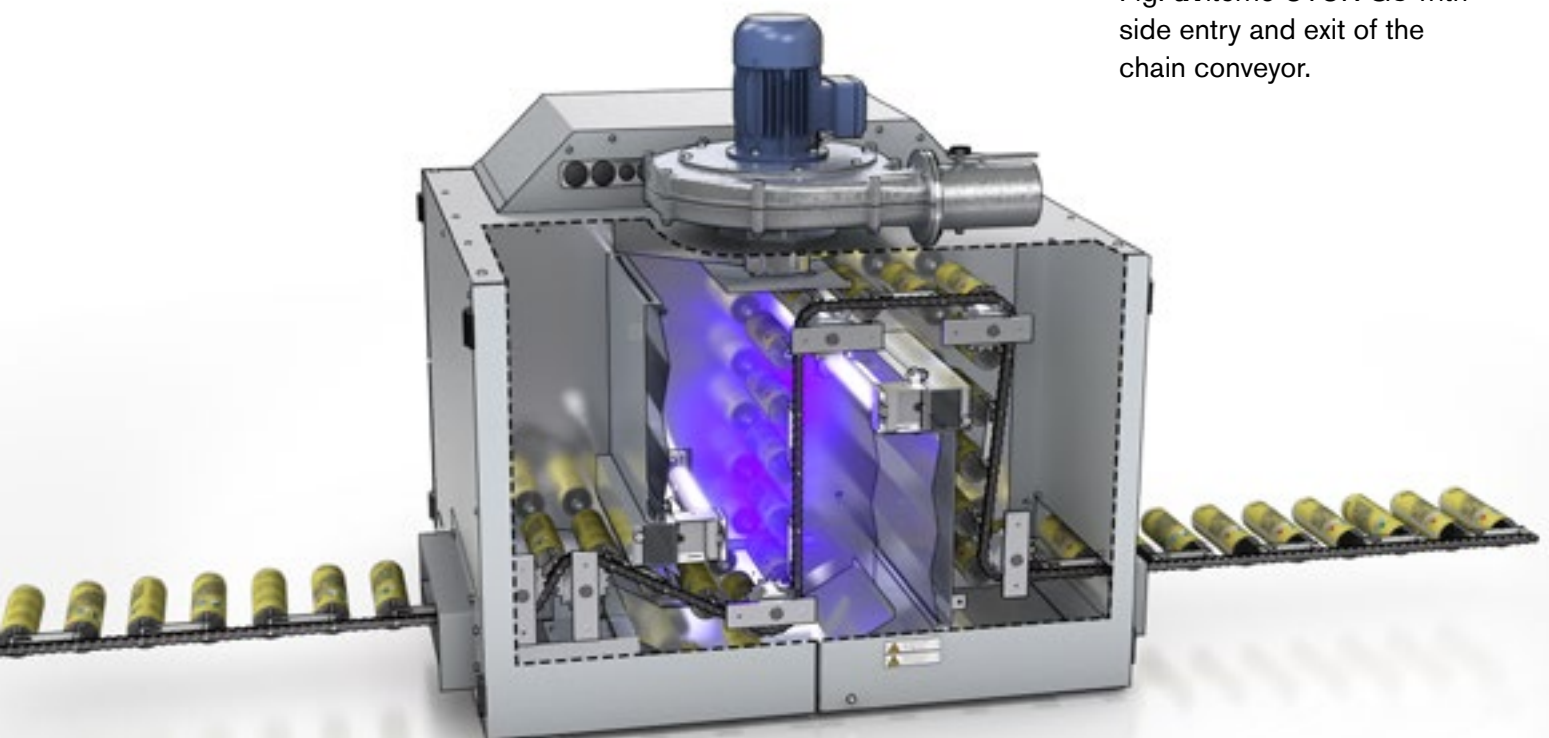


Fig. **uviterno** UTUK G3 with side entry and exit of the chain conveyor.

Varnishing Unit

In order to be able to work at high cycle rates in production, all parameters of UV curing must be within the optimum operating window. With the **uviterno** varnishing unit, manufacturers of inks and varnishes can apply these to cylindrical form test bodies with a high reproducible repeatability. This allows curing and application-specific preliminary

tests to be carried out. End users can also test the material compatibility of substrates with the desired ink and varnish combinations. This provides important insights for development while allowing for process parameters to be brought into the optimal operating range.

Technology

- + tube width 40 - 200 [mm]
- + tube inner diameter 16 - 70 [mm]
- + varnishing unit 620 x 655 x 274 [mm]
- + control cabinet 380 x 350 x 600 [mm]

Typical Applications

- + ink development
- + varnish development
- + preliminary tests
- + process optimization

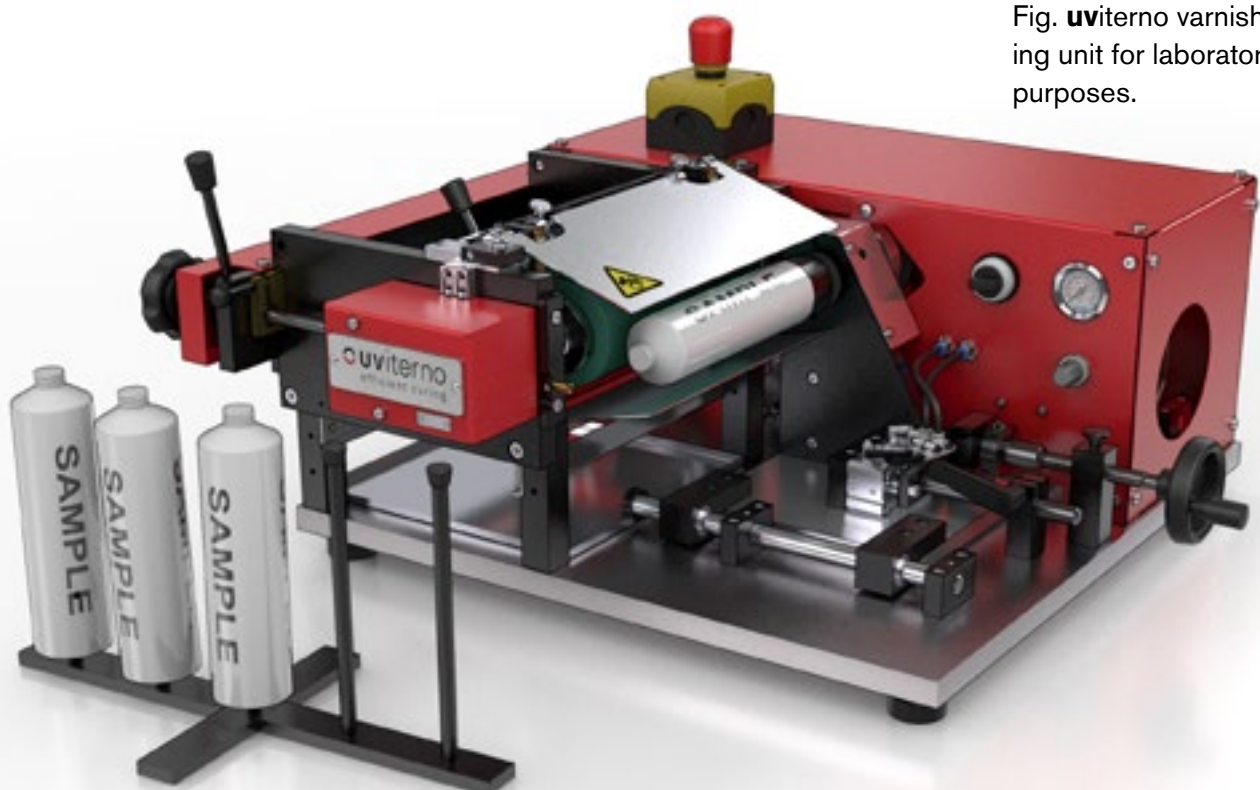


Fig. **uviterno** varnishing unit for laboratory purposes.

We are Swiss

Our company – **uviterno AG** – is located in eastern Switzerland, strategically situated near the borders of Germany and Austria. Presumably, we are a typical medium-sized Swiss company.

The Swiss are said to be a little reserved. We'll leave it up to others to decide whether that applies to us. But what we do know is this:

With us, a promise and a handshake still count for something. We prioritize investments into the development of new products rather than in marketing. On a constant lookout for the best solutions, we are always looking to realize even the most demanding and complex wishes of our customers.

So, perhaps we'll be hearing from you soon?



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