



LED technology for UV systems

Design – Features – Applications

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 p-n 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: 315-380nm) or the shortwave segment of the visible spectrum are mainly used for industrial UV applications. The most prominent types are currently 365nm, 385nm, 395nm and 405nm. 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.

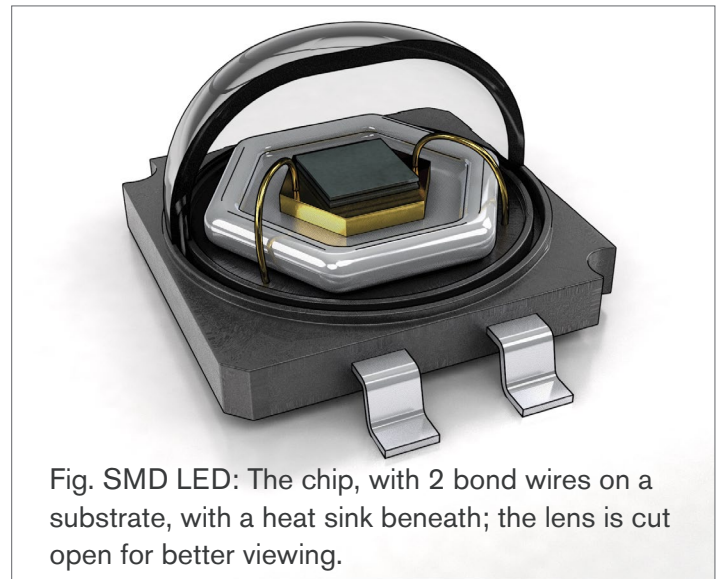
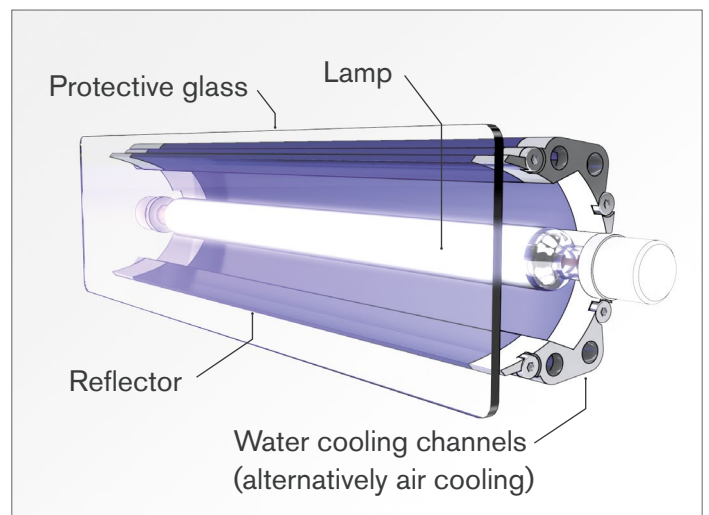
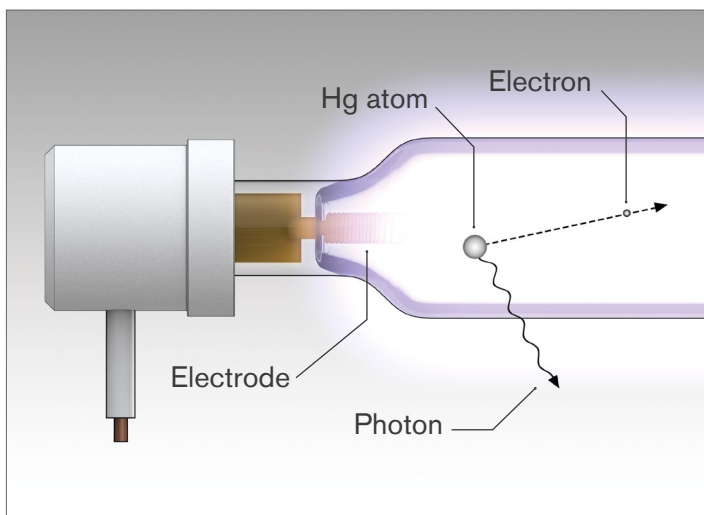


Fig. SMD LED: The chip, with 2 bond wires on a substrate, with a heat sink beneath; the lens is cut open for better viewing.

UV generation with Hg lamps

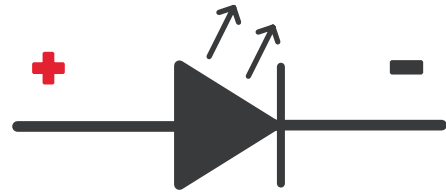
A heat-resistant quartz glass bulb contains a small amount of mercury as well as argon, which supports the ignition process. A high voltage is applied to the electrodes located in the lamp base. The electric field accelerates free electrons, which release further electrons and ions via impact ionization 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 unwanted heat.

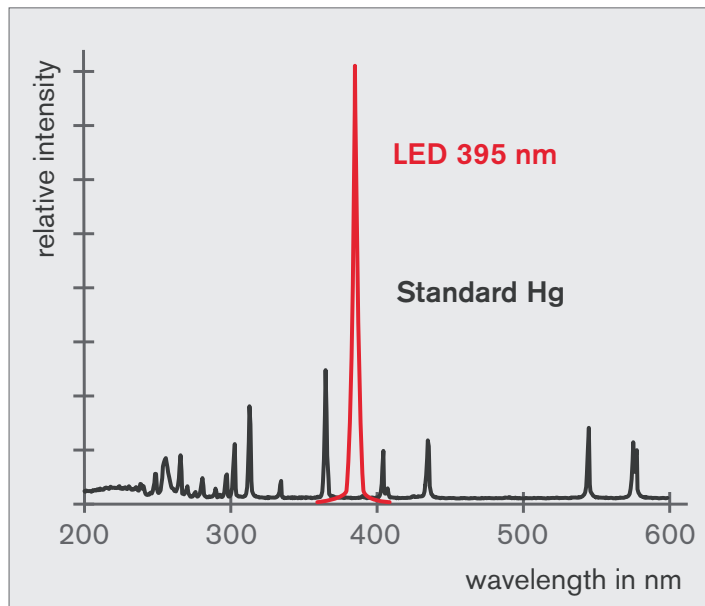


The semiconductor

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



Discrete spectrum in UV-A

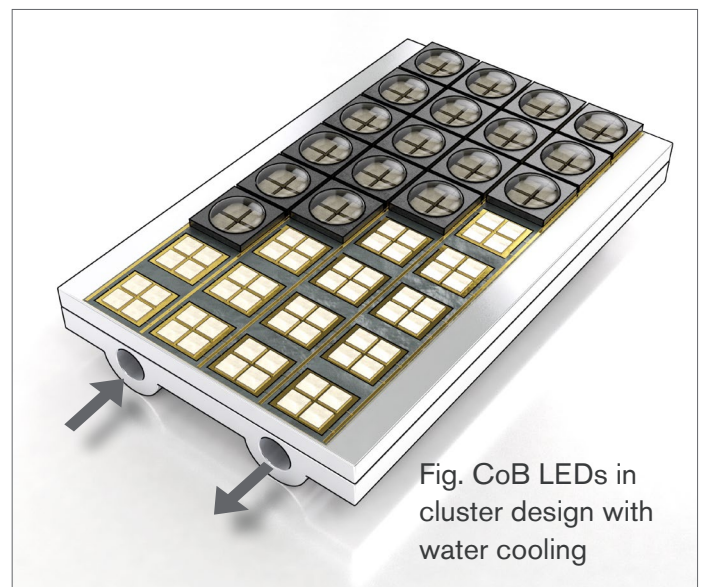
The spectrum of UV LEDs depends on the choice of semiconductor materials. In contrast to the Hg lamp, the LED emits only one main line at a time, but this line is very intense. Depending on the semiconductor selected, 365nm, 385nm, 395nm or 405nm wavelengths are currently possible. There is no emission in the infrared range, which protects the substrate. Moreover, nothing is emitted in the extremely short wavelength range below 240nm, which prevents ozone formation.

- + 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. UV LEDs do not require shutters, enabling the design of very compact and versatile units.

- + compact machines possible
- + flexible installation options



New applications

As a pioneer of UV technology, **uviterno** offers sophisticated and modular UV LED systems. The company is focused on performance, durability and flexibility. LED systems from **uviterno** offer a particularly clear advantage when the curing process is discontinuous or clocked. Our systems can be switched on and off within milliseconds and require no warm-up time compared to Hg systems. Since no heat is radiated from our UV LEDs towards the substrate, even very sensitive substrates, such as thin films, can remain positioned close to the UV head after switching off without suffering heat damage! And since constant switching cycles do not reduce the service life, maximum energy savings can be made with our systems during off-time.

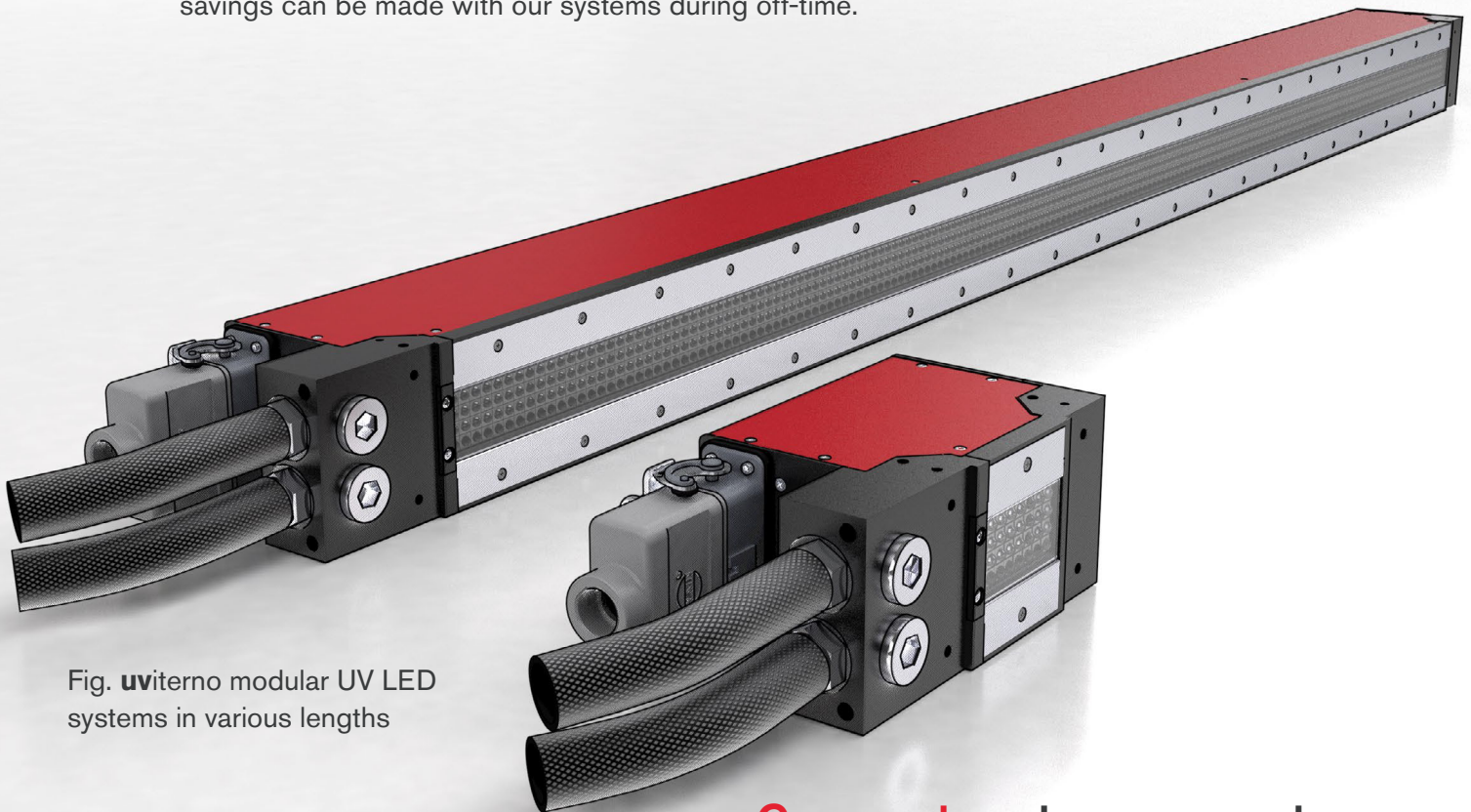


Fig. **uviterno** modular UV LED systems in various lengths

Compact system concepts

Environmentally-friendly & safe

UV LEDs from **uviterno** do not contain any free toxins and do not produce any toxic gases during operation. This not only reduces the ecological footprint, but also simplifies the maintenance and operation of the system for personnel.

If no ozone is produced, no ozone needs to be extracted! Since no heat is radiated from our UV LEDs towards the substrate, the machine does not need any complex exhaust or cooling air circuits to protect the substrate from thermal damage. The **uviterno** UV LED systems are equipped with a highly efficient water cooling system, which enables utmost performance and a long service life. Likewise, our systems do not require any shutters or reflectors. Our systems can be cascaded modularly in different lengths. As a result, innovative system concepts can be implemented in which the UV components take up a minimum of space.

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. UV technology was rapidly progressing at the time and 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 the meantime in Liechtenstein.

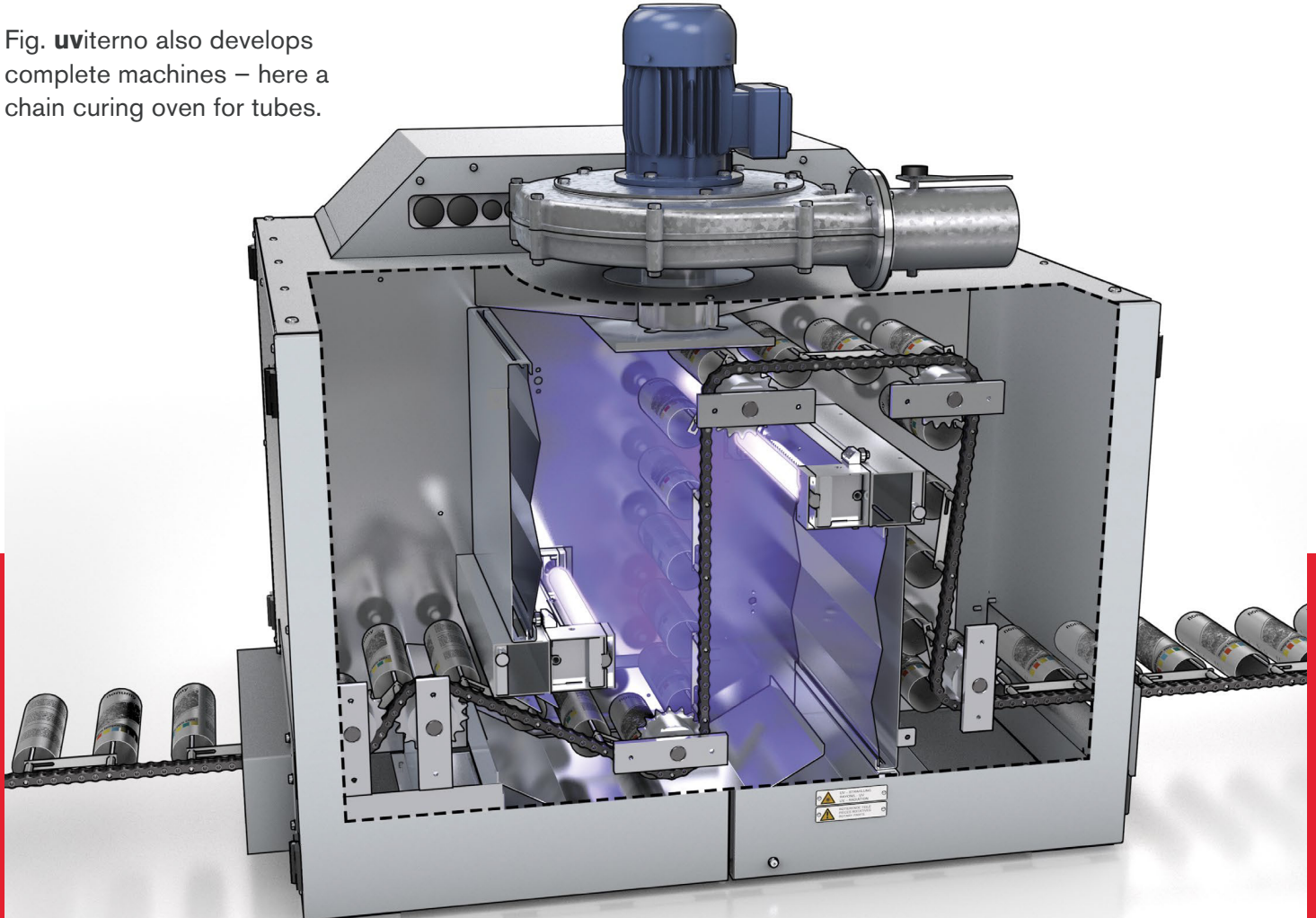
The present company **uviterno** was founded in 1986. Dr. Przybilla and his Ultralight AG maintained a friendly and business relationship with our three founders. Over the years, Dr. Przybilla acquired all shares from the original shareholders. When his son Dr. Karl Przybilla jun., who likewise holds a PhD in physics, took over the management in 2006, the story came full circle.

Specialists in UV polymerization

With more than 30 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.

uviterno's customers benefit from a significantly expanded range of applications with the new UV LEDs, which have been developed to market maturity. Though UV LEDs will not replace Hg lamps in the near future, they will enable completely new applications.

Fig. **uviterno** also develops complete machines – here a chain curing oven for tubes.



We are Swiss

Our company – **uviterno AG** – is located in eastern Switzerland, strategically located near the borders of Germany and Austria. We are a presumably 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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