# PHOTONICS NEWS

Company Newspaper of the LASER COMPONENTS Nordic AB

lasercomponents.se
#13 ▪ 02|2022

UV Water Treatment

Photovoltaics

Fire Protection

New Products

## PHOTONICS @ HOME

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## *Editorial*

Dear Reader,

Photonics is the key technology today and in the future; it has the unlimited potential to enhance innovation in several industries. The versatile technology of generating, guiding, manipulating, amplifying, and detecting light is behind many of the innovations which have transformed the way we live. In this issue of Photonic News, we will take a closer look at applications in your home environment where photonics is the key enabling technology.

At LASER COMPONENTS, we have been serving customers since 1982 with sales branches in five different countries. We have been producing in house since 1986 with production facilities in Germany, Canada, and the United States. In-house production makes up approximately half of our sales revenue.

We will be celebrating our 40th anniversary this year and now employ over 250 people at the seven LASER COMPONENTS' locations worldwide. This number has more than doubled in the past 10 years. Summarizing 2021, we have broken all the records set in the past. In terms of sales, we have been able to record an increase of around 25% globally and above 50% for the Nordic market.

To support all our sites in this growth in the best way possible, we decided some time ago to establish a holding structure. The parent company, which will henceforth operate under the name Photona GmbH, will support its subsidiaries by providing internal services in the areas of quality management, efficiency, financing, controlling, digitalization, and IT solutions. In keeping with the spirit of a family business, the areas of culture, image, and corporate values are also anchored in the holding company and are binding for all subsidiaries. In addition, the holding company sets the common goals and the coordinated strategic direction. The team will soon be expanded to include new business development and new technologies.

With this new structure, we retain the flexibility typical of medium-sized companies and at the same time utilize centrally available expertise that is normally only found in companies that are significantly larger than us.

Yours,

Fredrik Wikfeldt
CEO, LASER COMPONENTS Nordic AB

## *Content*




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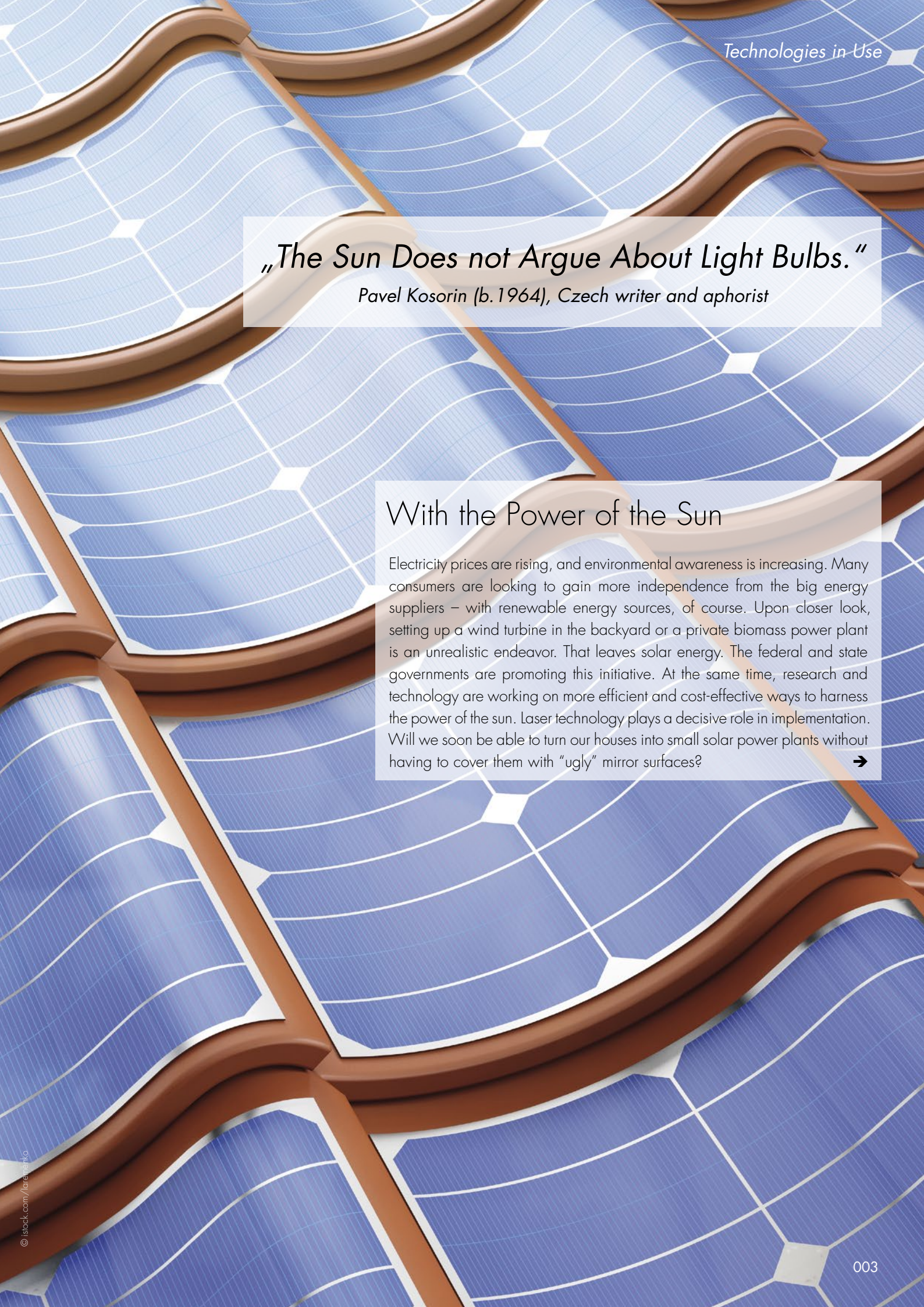

*„The Sun Does not Argue About Light Bulbs."*

*Pavel Kosorin (b.1964), Czech writer and aphorist*

## With the Power of the Sun

Electricity prices are rising, and environmental awareness is increasing. Many consumers are looking to gain more independence from the big energy suppliers – with renewable energy sources, of course. Upon closer look, setting up a wind turbine in the backyard or a private biomass power plant is an unrealistic endeavor. That leaves solar energy. The federal and state governments are promoting this initiative. At the same time, research and technology are working on more efficient and cost-effective ways to harness the power of the sun. Laser technology plays a decisive role in implementation. Will we soon be able to turn our houses into small solar power plants without having to cover them with "ugly" mirror surfaces? ➔

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# Will Transparent Solar Cells Soon Be Available?

## Laser Innovation Brings Photovoltaic Production Back to Europe

Solar cells have been used to generate electricity since the 1950s – initially, mainly in places where no other power sources were available (e.g., to power satellites in space). With its increase in energy yield, photovoltaics (PV) also became interesting for business and politics. It is now considered a cornerstone of a sustainable energy supply. In August 2021, the Green Party in Germany submitted a motion in parliament for a Solar Energy System Expansion Acceleration Act. According to this act, a photovoltaic system would be mandatory for every new building. In some federal states, corresponding provisions are already being implemented.

Solar silicon
must be 99.99 % pure.

Principally speaking, a solar cell is any technology that uses the photo-electric effect to generate electricity from light. Typically, silicon and other semiconductors are used. Silicon exists abundantly in the form of chemical compounds (e.g., as silicon dioxide in sand). However, for solar cell technology a purity of 99.99 % is required because any contamination has a negative effect on the service life of the solar cells. The production of this so-called solar silicon is a complex, energy-intensive process with numerous intermediate steps. Congruently, the production of PV modules is expensive.

Industry and research have, therefore, long been searching for alternatives to the classic solar cell. Two of them are presented in this article: In the first case, the aim is to increase the efficiency of Si cells and make production more efficient by using laser technology. In the second example, an alternative material is used. Here, too, lasers play a crucial role in production.

### Heterojunction – Higher Efficiency

Heterojunction technology (HJT) is when two different semiconductor materials come together. In the case of solar cells, this involves silicon in two different crystal structures: crystalline and amorphous silicon. HJT cells, therefore, absorb more solar energy than conventional cells. At the same time, the resistance in the module decreases, causing the efficiency to increase to up to 25 percent. Thus, HJT cells can still deliver electricity even, for example, when the sky is cloudy. In addition, their performance does not diminish even at high temperatures. They are said to have a low temperature coefficient.

The Swiss manufacturer Meyer Burger Technology Ltd. has further developed this technology, which originated in Japan, and is currently starting production in Germany. The fact that production was not outsourced to a low-wage Asian country, as is usually the case, is also due to a novel laser cleaving process developed by Innolas Solutions. Instead of scratching the wafer and then breaking it mechanically, the machine does both in one step. The local, induced voltage of the laser beam allows the silicon wafer to be split along an almost freely selected cell edge. This is not only faster than the conventional method, but the particle-free method also results in fewer microcracks. This would otherwise impair the quality of the solar cells. Since the wafers are not broken mechanically, the cell breakage rate is also considerably lower.

Solar modules will soon be
flexible and transparent.

### Organic Materials – The Future of Photovoltaics

The future could belong to organic photovoltaics (OPV), which, in contrast to classic Si designs, rely on materials from organic chemistry – primarily synthetic carbon compounds. Most of these solutions are still in the developmental stage. However, there are some research projects running that are already testing their industrial production.

Organic solar cells offer many advantages. First, they eliminate the need for time- and energy-consuming silicon preparation. The only metallic components of the cells are electrodes, through which the generated current is channeled. In most cases, copper, which is abundant in nature, is used for this purpose. The plastics used in the generation of electricity can also be used sparingly. Three grams of active material are enough for an area of ten square meters. The plastic layers are suitably thin; therefore, they can be "printed" onto almost any type of substrate using the roll-to-roll process.

This also makes it possible to produce flexible modules and transparent versions. All these advantages open numerous new application possibilities. Organic solar cells could be integrated into buildings, facades, and glass surfaces, for example, and could capture solar energy directly where it is consumed.

Three grams of plastic are enough for ten square meters.

The biggest disadvantage of this technology is currently still its low efficiency. The highest value achieved in the laboratory was around 12 percent. On average, however, experts currently expect around 7 percent. This means that considerably larger areas would be needed to achieve the same effect as with conventional cells.

## Precise Cuts in the Femtosecond Region

The roll-to-roll process allows large areas of solar cells to be produced quickly. However, this also poses a challenge because the larger the area, the higher the amperage of the generated current. To transport the current, cables with a large cross-section are needed, which would impair the flexibility of the cells. But there is a trick: if the total area is divided into numerous small cells, the energy yield remains almost the same and the current intensity drops to an acceptable level.

"The challenge is to remove the plastic layers, which are only nanometers thick, in such a way that the underlying layers are not damaged or short-circuited," says Ludwig Pongratz of the Fraunhofer Institute for Laser Technology (ILT) in Aachen. "Only a laser can do that." To scratch off the layers (in technical jargon, it is referred to as "scribing"), researchers use a femtosecond laser. For an extremely short period of one quadrillionth of a second, a beam of such high intensity is generated there that the material removed is converted directly into plasma without leaving any residue, while the substrate does not heat up to any notable temperature. The individual pulses are repeated at a repetition rate of 200 kHz. This results in very precise cuts. At ILT, diffractive optical elements divide the beam into eleven partial beams and direct them onto the material, creating a module with twelve parallel rows of cells.

In addition to scribing, the research project also uses lasers to carry out other operational steps (e.g., a highly efficient drying process and the encapsulation of the photovoltaic cells). Thanks to the latest laser technology, nothing should stand in the way of industrial mass production and the use of organic solar cells. ■


## Optical Components in Laser Material Processing

Coatings for mirrors, lenses, beam splitters, and other optics for industrial lasers in the wavelength range of 1030 nm and 1080 nm have been part of LASER COMPONENTS' core business for 35 years. Our customers include well-known laser manufacturers from all over the world, to whom we supply large quantities of high-quality products for their systems. However, we also manufacture small and very small quantities of customized optics, such as those used in research institutes or for special applications. Here, it is often a matter of precisely meeting very specific requirements. ■

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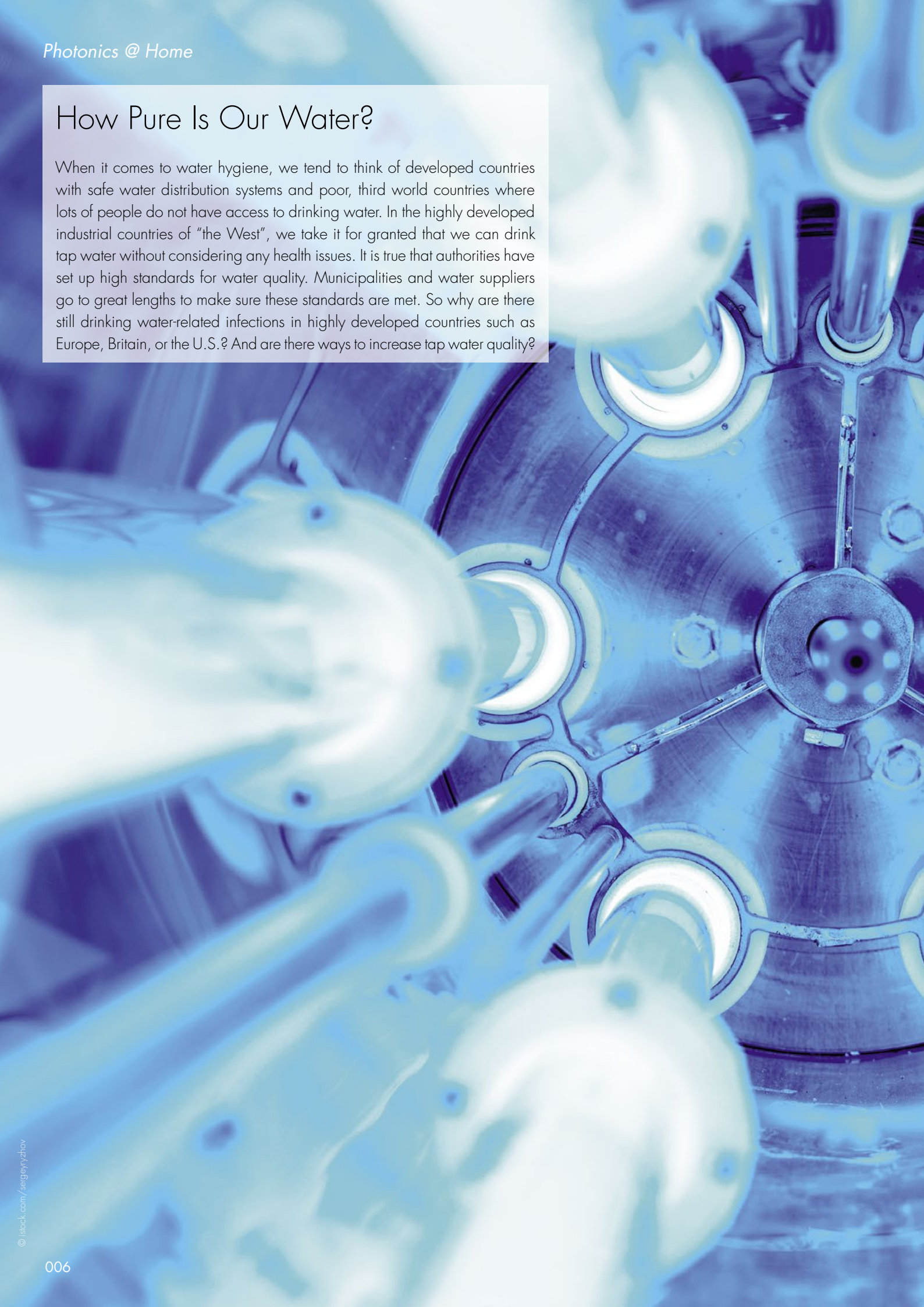
A sensitive task: USP laser-scribing in the fs region is used to ablate nanometer-thin layers on a moving film.

# How Pure Is Our Water?

When it comes to water hygiene, we tend to think of developed countries with safe water distribution systems and poor, third world countries where lots of people do not have access to drinking water. In the highly developed industrial countries of "the West", we take it for granted that we can drink tap water without considering any health issues. It is true that authorities have set up high standards for water quality. Municipalities and water suppliers go to great lengths to make sure these standards are met. So why are there still drinking water-related infections in highly developed countries such as Europe, Britain, or the U.S.? And are there ways to increase tap water quality?



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# Drinking Water Put Under the Microscope

## Fighting the Invisible Threats with UV Radiation

Contaminated water is one the main causes for many deadly epidemics such as cholera, dysentery, or typhoid fever. It was not until the mid and late 1800s scientists and physicians like John Snow, Robert Koch, or Louis Pasteur discovered the importance of water hygiene. Since then, an ever-increasing amount of effort has been put into hygiene and sanitation. Authorities such as the EU, the U.S. Environmental Protection Agency (EPA), and the World Health Organization (WHO) issue strict quality guidelines for drinking water. In most first world countries water-induced infections have been more or less irradicated, but still occasional outbursts occur – especially when the public water supply is interrupted by natural disasters such as floods, landslides, or hurricanes.

### One of the Best-Controlled Foods

Most of the drinking water that is supplied to our homes comes from natural sources such as lakes, rivers, and groundwater – sometimes even from protected natural reserves. Nonetheless, this water undergoes elaborate purification treatment at water treatment plants before being distributed to the consumers. The exact process differs from case to case, but in most cases, it includes the following steps:

- **Coagulation and Flocculation:** Chemicals with a positive charge are added to neutralise the negative charge of particles that are dissolved in the water. Both react with each other to form larger particles called floc.
- **Sedimentation:** Due to its weight, the floc settles at the bottom of the water supply.
- **Filtration:** The clear water at the top is sent through various filters (e.g., sand, gravel, and charcoal) to remove finer particulate matter such as dust, organisms, and even dissolved chemicals.
- **Disinfection:** Remaining parasites, bacteria, and viruses are killed by disinfecting chemicals or UV radiation.

**Did you know?**[1]

- … that one third of the global population does not have access to safe drinking water.
- … that almost 6 billion people could be living in areas with temporary water shortage by 2050
- … that the lives of more than 360,000 infants could be saved every year, if they had access to climate-resilient water supply and sanitation.
- … that climate-induced water stress can be reduced by up to 50%, if global warming is reduced to 1.5 °C above pre-industrial levels.

To avoid the risks that come with the use of toxic chemicals, many large-scale plants use UV light treatment as part of the purification process. The most effective wavelengths are in the UVC part of the ultraviolet spectrum, which ranges from 100 to 280 nm. They are absorbed by DNA and RNA strands of viruses and microbes and break down the chemical bonds that form the double-or single-helix structure respectively. The germs are thereby destroyed or at least no longer able to replicate.

> Water is the most thoroughly controlled natural resource.

So far, sources for the highly effective UVC light were limited to low-pressure mercury lamps. Given their size and shape, these light sources are only fit for use in larger facilities. In addition to that, they are fragile, difficult to operate, and the disposal of toxic mercury is complex and expensive. With the emergence of high-power UVC LEDs, UV treatment is now also available for everyday use in homes.

### Germ-Free Tap Water

Why is there any need for water treatment at home, if drinking water undergoes all these purification measures? The problem is that local authorities are only responsible for the water delivered to your home. Whatever happens on the customers' premises is their own responsibility, and there is a lot going on in the pipes and reservoirs of every private household and company facilities.

As long as the water is in motion, it is most likely to remain as clean as it was provided by the local utilities. As soon as it stands still for some time, micro-organisms begin to group together in slimy, glue-like substances, which allow them to stick to surfaces. These so-called biofilms consist of a wide variety of bacteria, fungi, and single-celled organisms. They are most likely to be found on the inner surfaces of water pipes, water storage tanks, or water heaters.

The biofilms themselves are not dangerous. Scientists even found out that they contain many organisms that contribute to keeping the water clean. On the other hand, biofilms also serve as a breeding ground for many dangerous pathogens and their slime "shield" protects them against chemical

1 https://www.un.org/en/observances/water-day

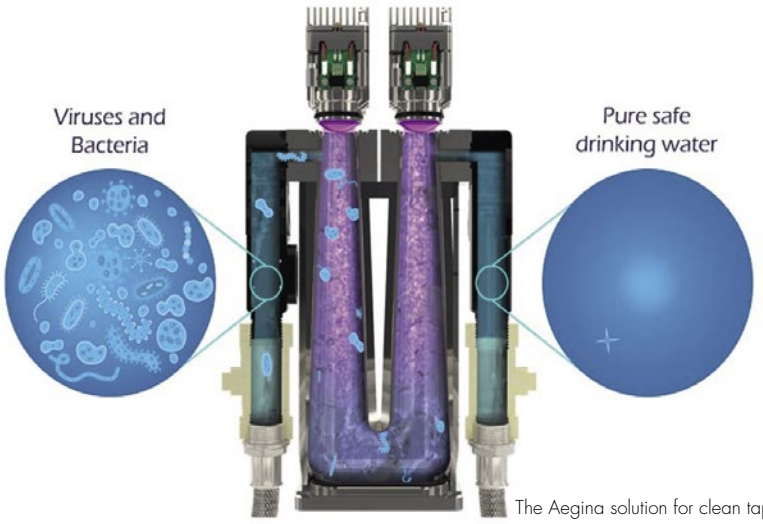
disinfectants such as chlorine. Biofilms in the water piping system may release germs into the otherwise clean water. Therefore, additional disinfection is recommended.

UV irradiation is a well proven way of water purification.

A highly effective method is to use UVC close to the consumer – just before the water leaves the tap. LEDs allow for space-saving, affordable and environmentally neutral solutions such as the Aegina Purifier line, developed by British manufacturer PRP Optoelectronics. The UVC sources used by the company comply to the NSF 55 Class A Standard which covers inactivation of microorganisms, including bacteria, viruses, Cryptosporidium oocysts, and Giardia cysts, from water. This kind of radiation is also harmful to other lifeforms including humans. The LEDs in the Aegina system are therefore placed within the closed piping, so that they pose no harm to humans or their pets. For increased

LED technology brings disinfection technology to the home.

safety, the UV light will automatically switch off if there is any alteration or damage to the system. The water is led through a U-turn in order to provide the time and amount of radiation necessary to destroy all germs. It also remains in motion during the whole process to avoid new contamination. With these measures the Aegina modules are able to deliver 99.99 % clean water. With their low power consumption, the devices are designed for residential and mobile use. Depending on the model, they offer outputs of 3, 6, 12 and 18 litres of high-quality drinking water per minute. ■




© PRP Optoelectronics Ltd / aegina-pure.com

The Aegina solution for clean tap water

## Germicidal UVC LED

The shorter the wavelength, the more UV radiation is absorbed by the Earth's atmosphere. This is why organisms on our planet have no natural defences against this type of light. The most efficient wavelengths for disinfection are between 250 nm and 280 nm. LEDs emitting in this spectrum are therefore called germicidal LEDs.

Our portfolio of germicidal LEDs includes wavelengths of 255 nm, 265 nm, 272 nm and 275 nm. Their optical power per chip ranges up to 100 mW. ■

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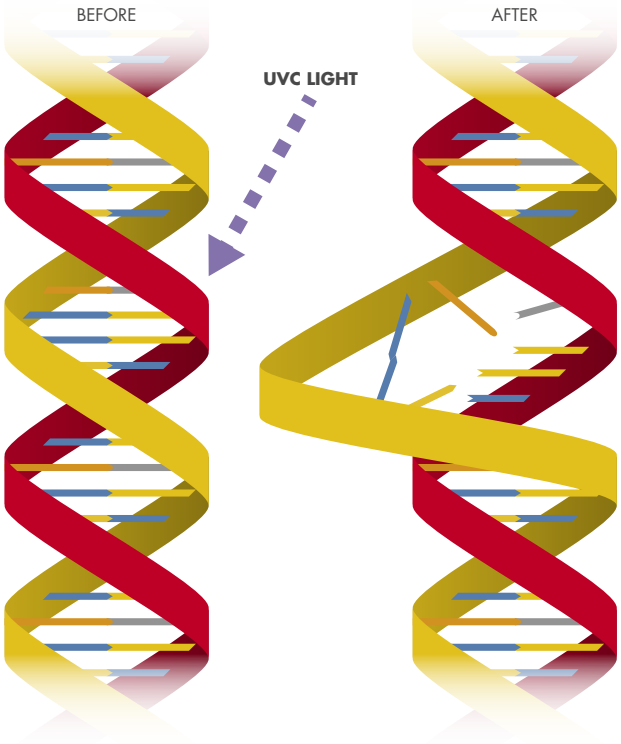



UVC radiation destroys the structure of DNA

# „It Is Useful to First See the Spark Before the Fire."

*Japanese proverb*

Residential fires are among the most feared dangers of everyday life. Luckily, we can take precautions: in many countries, homeowners are required to cover financial risks with fire insurance and experts recommend having a fire extinguisher ready at hand. Most of these measures only deal with the most obvious feature of a fire, though: the flames. For a long time, the most dangerous aspect went unnoticed. Most of the fire-related deaths are caused by smoke. It was not until about a decade ago that authorities in many countries took this into account and made smoke detectors mandatory for all homes.

## There Is no Smoke Without Fire

### Optical Technologies in Fire Protection

#### Silent Killers

In 2019, approximately 90% of the fire related deaths and injuries in the U.S. occurred in homes or apartments.

Smoke is more deadly than fire.

There are no official statistics for the EU but estimates of the European Fire Safety Alliance show similar rates at approximately 80%. In those cases, most people do not die from the flames, but from the smoke.

Depending on the burning materials and on the amount of heat generated by the fire, smoke consists of different gases. All of them are dangerous, but in different ways.

The most frequent and deadly components are the so-called "toxic" gases, which include carbon monoxide (CO), carbon dioxide ($CO_2$), and even hydrogen cyanide (HCN). They affect respiration in different ways: Carbon dioxide is commonly known as the "waste product" of respiration that is released when we exhale. The problem is that the whole metabolism gets out of balance when the $CO_2$ concentration increases. If the air you inhale contains more than 10% $CO_2$, you will be dead in less than a minute.

Carbon monoxide is just as lethal, but in a different way. Its molecules attach themselves to the hemoglobin in the human blood, which is there to transport oxygen to the cells. As an effect, the cells do not get enough oxygen to function causing the body to suffocate. The most dangerous fact about CO is that it does not have a smell or taste. Cyanide causes breathing difficulties very rapidly when it is inhaled or absorbed through the skin. Like CO it also affects the metabolism, but on a different level, prohibiting energy production within the cells. Actually, most victims suffocate in their sleep before they even notice the fire.

This is, where smoke detectors kick in. As soon as they detect a potentially dangerous amount of smoke, they set off an alarm and make sure that the inhabitants wake up. ➔

## IR-Detection Saves Lives

In most cases, smoke detectors use optical technologies. The concept is as simple as it is effective: It consists of a light source, some small mirrors, and a photodiode. The mirrors guide a light beam through a dark box and make sure that it never hits the detector.

Diffused light triggers the alarm.

As soon as smoke enters the box, the light is scattered and reaches the photodiode, which then triggers the alarm. However, there has to be some type of margin: You do not want the alarm to go off with every candle you light. On the other hand, it should be triggered when said candle falls to the floor and sets the carpet on fire.

Home applications use a simple IR emitter and an off-the-shelf photodiode, while the more expensive industrial applications employ the more sensitive combination of a brighter (laser) light source and a more "professional" photodiode.

Whether in the home or in a business, all smoke detectors require smoke to physically reach the detector. Valuable time passes on the way there, and the direction of movement of the smoke depends on numerous external factors. A small gust of wind can have a profound effect on the direction of the smoke. Optical flame detectors, on the other hand, do not require contact: they work quickly and from a distance. Their IR sensors react to the flickering of flames or sparks. An algorithm analyzes whether they correspond to patterns that occur during fires. For example, they are also able to detect sparks through windowpanes, billows of smoke, and dense fog.

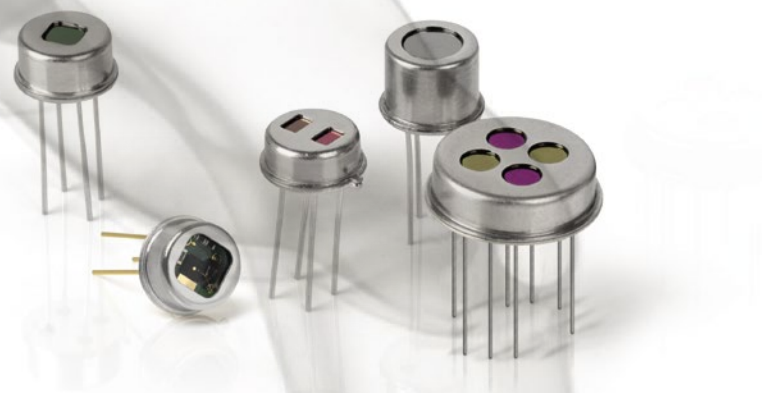
Spark detection is particularly important where explosive dust floats in the air (e.g., in wood processing, grain processing, and cement plants). The key here is to react quickly and, if possible, extinguish the sparks while they are still in flight to prevent any further damage. Quantum detectors (PbS, x-InGaAs) dominate these sensors.

Another industrial application is flame detection. In this environment, many fires originate from the combustion of hydrocarbon compounds. Such fires often spread farther than the visible flames would suggest. Pyroelectric detectors can be used to determine their true extent. This sensing technology

IR sensors detect flying sparks and invisible fires.

detects the products of combustion, such as $CO_2$, by measuring light emissions at specific wavelengths. At hot temperatures, gases emit the same wavelength of light that they otherwise absorb. This makes it possible to clearly determine the type of gas in the detector's field of view. Pyroelectric detectors are always used in combination with infrared filters that block out the "ambient noise" generated by solar radiation or by atmospheric $CO_2$. For multispectral detection of IR radiation from flames, a multiple combination of three or more detector/filter pairs is usually used.

All of these systems operate quickly and with extreme precision because in industry you cannot afford false alarms. If sprinkler systems or other extinguishing systems are triggered incorrectly even once, the consequences can be just as devastating as a fire.



## Extensive Range of Detectors

Smoke and fire detectors come in many configurations and price ranges. The detector technologies used in them are correspondingly diverse. Each technology has its specific advantages. With a wide range of IR components, LASER COMPONENTS ensures that you always use the optimal technology for your fire protection solution. The best detector does not necessarily always have to be the most expensive.

LASER COMPONENTS Detector Group in Chandler, Arizona manufactures pyroelectric, PbS, and x-InGaAs detectors according to customer specifications. ■

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### Intelligent Solutions Go One Step Further

Standard solutions have thus far included combining the smoke detector with either a heat sensor or a carbon monoxide sensor. DEF, a French solutions and services provider of fire safety systems, recently developed an intelligent, connected device that combines all three of these technologies for the first time. Most standardized multi-sensor detectors combine smoke detectors with either heat or carbon monoxide. The premium version of this solution is self-learning: It uses built-in algorithms to process the signals from the various sensor technologies.

For this purpose, they record and analyze the alarm context and the last 100 events. In this way, they can determine the type of fire and thus adapt their sensitivity to allow for earlier detection but also reduce the number of false alarms.

While the first of these multi-functionality devices were designed as premium products for factories and shopping malls, they are already on their way to the common living room. As part of a smart home, they could be controlled with any type of mobile device and allow you to react to dangerous situations, when you are miles away … assuming you have access to a high-performance data network. ■

# NEW PRODUCTS

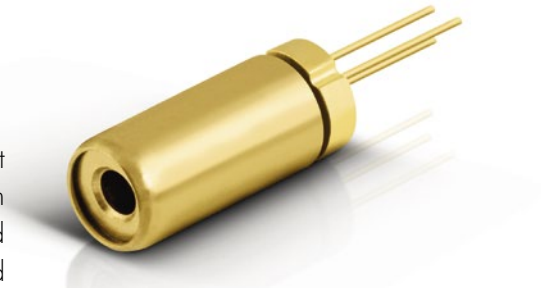
## Saves Space and Cost

### Green Dot and Line Lasers for Positioning Applications

WEB N13-174

LASER COMPONENTS' low-cost segment offers green dot lasers with the smallest housing in the world. With a diameter of just 3.3 mm and a length of 7.8 mm, the LC-LMD-515-07-01-TM-01 module can be effortlessly integrated into almost all product designs. Despite its tiny dimensions, the module with a laser power output of 1 mW is suitable for all common positioning applications.

The green line lasers in our product range also have a compact design with housing diameters of 9 mm and 11.5 mm. With a fan angle of 60° and a maximum laser power output of 3 mW, the LC-LML-515-09-03-60-TM-C module ensures that the laser line can still be used reliably for alignment tasks across longer distances. With a fan angle of 120°, the LC-LML-515-01-03-TM-C module



generates a particularly long line even in confined spaces for precise positioning tasks in industry and trade crafts. ■

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## Guaranteed Eye Safety

### Green Laser Diodes with Automatic Power Control

WEB N13-048

In its new line of green automatic power control (APC) laser diodes, Arima Lasers has made power control much easier. Whenever eye-safe laser radiation is required, the new model offers additional protection. If certain operating current levels are exceeded, the laser source switches off automatically. The control electronics are located as an ASIC on the same chip as the photodiode and the emitting laser diode.

The new laser diodes emit at 520 nm and are integrated in a compact 3.3 mm TO housing. They are insensitive to electrostatic discharge up to 10 kV, guarantee stable output power at supply voltages from 5.8 V to 7.0 V (DC), and can be modulated up to 2 MHz. ■

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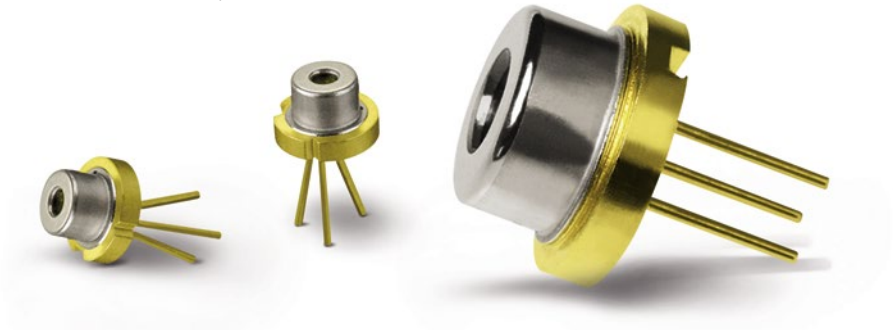

## Pyroelectric Detectors for the Detection of Hydrogen Flames

**More Safety for the Driving Force of the Future**

WEB N13-033

Flame detection is a crucial safety feature for the hydrogen-powered cars of the future. This applies to burner control in the engine, as well as to open flames at hydrogen filling stations.

$H_2$ flames are invisible to the eye but can be detected by IR detectors (e.g., the L2200D1810-JH from LASER COMPONENTS). With a newly developed IR filter combination, this pyroelectric detector measures the IR emissions of water molecules at 2.95 µm as produced during the combustion of hydrogen. This component is supplied as a dual-channel detector in a rugged TO-39 housing. ■

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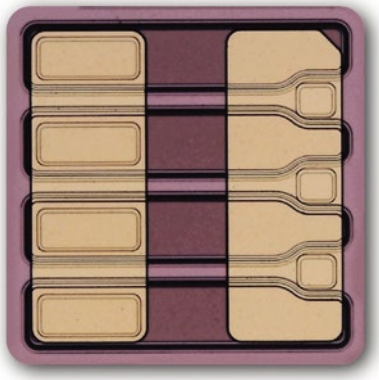
## Wide Range of UV Solutions

**Broad Variety of UVB and UVC LEDs**



WEB N13-042

LASER COMPONENTS now offers UV LEDs from the South Korean manufacturer Photon Wave. The range of products includes UVB wavelengths of 295 nm and 308 nm, as well as UVC LEDs with 255 nm, 265 nm, and 275 nm. All components are available as SMD chips or bare dies in various sizes to be quickly and easily integrated into a wide range of applications. The power range extends from a few milliwatts to 100 mW per chip. This is currently the highest power possible. With operating voltages between 5.7 V and 6.3 V, all LEDs are also suitable for mobile use.

While UVC wavelengths are replacing mercury vapor lamps in the disinfection of air, water, and surfaces, the UVB spectrum is used in such diverse fields of application as horticulture and dermatology. ■

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## Higher Level of Disinfection in Less Time

**Bundled Beam for Higher Intensity**

WEB N13-142

The higher the intensity of UVC radiation, the shorter the irradiation time for efficient disinfection. The latest addition to Bolb's S6060 series delivers focused UVC radiation at a 33° beam angle. This is provided by a lens integrated into the chip design. Compared to the standard 150° models, the narrower beam angle means that the intensity of the UVC radiation remains high even at some distance from the LED. At a distance of 10 cm, it is still 1 mW/cm². Within 3 seconds, for example, a dose of 3 mJ/cm² would be reached. This is a crucial advantage for use in the disinfection of water, air, and surfaces.

Like all other LEDs in the series, the S6060TL is supplied as an SMD chip and can be installed directly in the boards of the application. ■

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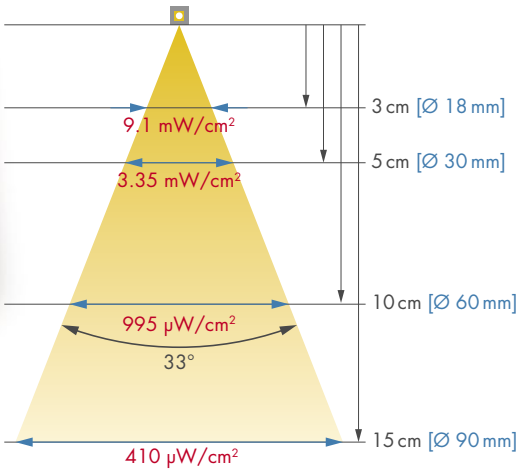


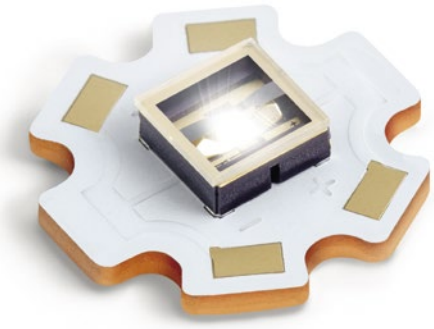
## SMD White Light Sources

### Even Brighter with an Even Longer Operating Time

WEB N13-274

White light sources from KYOCERA SLD Laser offer high luminance with low heat generation. The company has recently added two new features to its technology. The manufacturer has been able to extend the lifetime of its 500 lumen chips to 10,000 hours, which is good news for anyone planning to use them in industrial applications.

Additionally, white light sources with 1,000 lumens are now available in the same 7×7 SMD housing. This innovation is especially interesting where the light is fed into a fiber for transmission: The small spot of light and extremely high luminance allow the use of very thin fibers in medical endoscopy; longer transmission distances are possible in industrial endoscopes. ■



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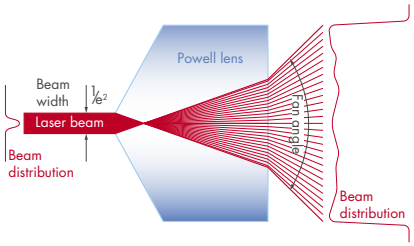
## Powell Lenses for Line Lasers

### High Quality "Made in Germany"

WEB N13-074

Powell lenses guarantee a homogeneous intensity distribution along a line and are therefore used to form a perfect line profile from the light of a laser diode. LASER COMPONENTS now offers these components from its in-house production. Manufacturing in Germany guarantees high availability with consistently high quality.

Powell lenses are manufactured with substrate diameters of 6 mm and 9 mm. You can choose from different specifications: For example, to produce as many line lengths as possible, you can choose from fan angles between 1° and 90°. In addition, we can adapt the lenses to different input beam diameters. The optics are also used in our own FLEXPOINT® laser modules. Therefore, we know what is important. Lenses




and complete line laser modules can be produced to meet customer specifications at any time. It is worth inquiring with us, even about small quantities. ■

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## Laser Pulse Energy Detectors for High Repetition Rates

### Measure Each Individual Pulse Precisely

WEB N13-071

When diagnosing and monitoring pulsed lasers, it is now possible to perform targeted troubleshooting at frequencies of up to 10 kHz. This is ensured by the pyroelectric measuring instruments of GENTEC-EO's QE12HR and QE25HR product series. Different models are available depending on the application and laser specifications:

- A basic version with a robust broad-band absorber is designed for repetition rates of up to 1 kHz.
- A version with a QED attenuator is recommended for high energy and power densities.
- If you need it fast, opt for a model with a metallic absorber. This means that even at repetition rates of 10 kHz, each individual pulse is still detected and measured.

With such fast-pulsed lasers, it was previously only possible to measure the average power and draw conclusions about the energy of the individual pulses. With this new measurement technology, it is now possible to detect the smallest deviations "in real time," such as individual weaker or missing pulses. In the laboratory, the reliability of pulsed lasers can thus be demonstrated. This makes it possible for corrective measures to be initiated


quickly during operation in industrial facilities, even before the disturbances affect the performance of a machine. ■

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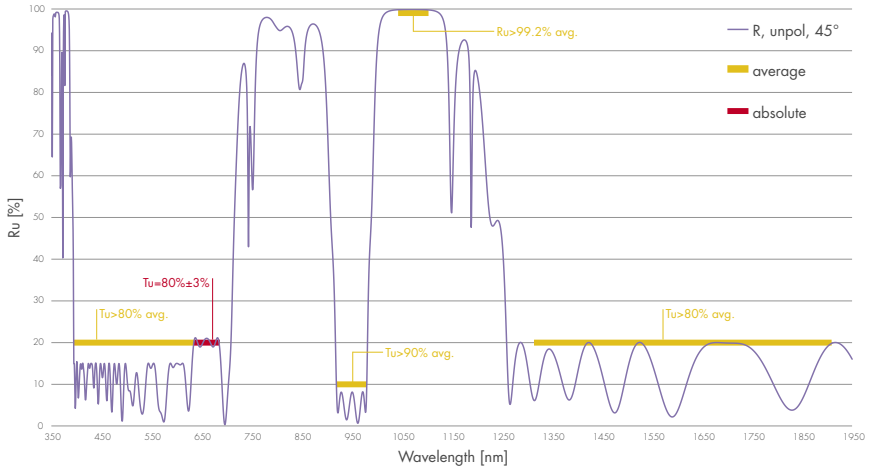
# New Monitoring Possibilities in Laser Material Processing

## Polychromatic Beam Splitters for Three or More Wavelengths

WEB N13-001

Complex sensor systems are at the heart of laser material processing in Industry 4.0; they control and monitor digitized processes. This also means new challenges for the optical components. It is not uncommon for a single optical system to have to direct the wavelengths for three or more detectors.

The solution is polychromatic beam splitters from LASER COMPONENTS: We have developed mirrors that not only transmit the signal for cameras in the infrared range (1300–1900 nm) and in the visible range (400–700 nm). Additional wavelengths can also be accommodated: for example, for a pilot laser (650 nm) or an optical coherence tomography (OCT) system for depth measurement (950 nm).




At the same time, the coatings are robust enough to permanently withstand a high-power laser for material processing (1030–1080 nm).

Which parameters do you need to monitor? Send us your requirements and we will develop the right coating design for your needs – no matter how complex they may be. ■

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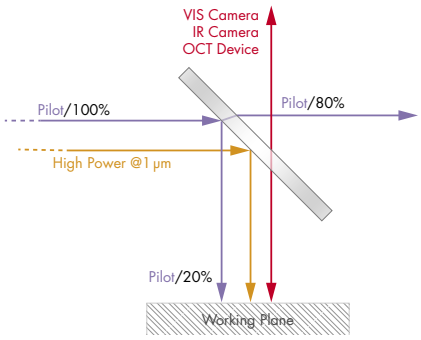



# Collimated Beams Directly from the Fiber

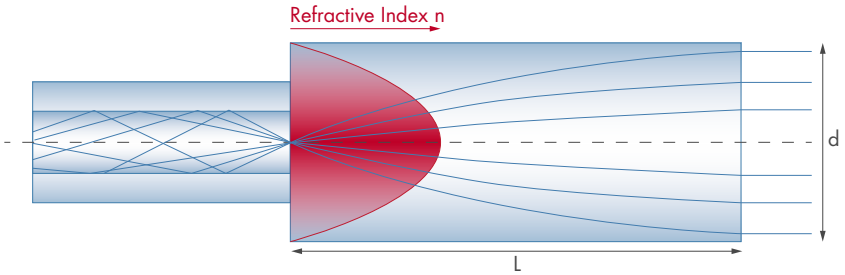
## Reproducible Quality: GRIN Lens Assemblies Produced in House

WEB N13-018

Everyone is familiar with the challenge of obtaining a collimated beam from an optical fiber. This works best when the collimator is directly bonded to the fiber, as with the GRIN lens collimators manufactured by LASER COMPONENTS. We use a process that does not require glue, thus enabling us to guarantee reproducible quality with this space-saving solution. External collimator mounting in a larger housing is no longer necessary going forward.

In the cylindrical graded-index lenses, the refractive index decreases continuously from the center to the edge to collimate the outgoing beam. They are currently offered with numerical apertures of 0.5 and 0.2.

In the standard configuration, the lenses are combined with an SMF-28 single-mode fiber and designed for the telecom wavelengths 1310 nm and 1550 nm. They are equipped with an FC connector, thus allowing the ferrule to connect directly to the fiber end.




Of course, we also manufacture versions for 650 nm and 870 nm. We are just as flexible in our choice of connectors. If you wish, we can even supply you with bare fiber solutions that you can integrate into your application yourself. Let us know your needs! ■

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LaserQube

# Active Laser Safety Booth

Reliable due to short response time (≤ 120 ms)

Available with roof on an optional basis

Up to 12 kW of laser power

Alternatively available as a passive laser safety booth

WEB N13-052

Active laser safety textiles with integrated automatic shutdown guarantees maximum safety. ■

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