PHOTONICS NEWS

Company Newspaper of the LASER COMPONENTS Nordic AB
lasercomponents.se
#10 ▪ 04|2019

Autonomous Driving

Laser Material Processing

Mobile Emissions Monitoring

New Products

Editorial

Dear Reader,

Autonomous driving is, as you're surely aware, a very hot topic these days. In fact, the automotive industry as a whole is opening up to the possibilities of photonics as more and more potential applications for the transport sector arise. From LiDAR to LED headlights, to laser welding manufacturing processes and gas emission analysis, there is a small revolution taking place, a revolution that will have a positive impact on many people's lives. Will driverless vehicles be dominating the streets ten years from now? Well, that remains to be seen, but one thing is sure: Driver assist systems will continue to show increasing complexity and LASER COMPONENTS is well positioned to play an active role in this exciting new development. Safer and more comfortable driving are only two key benefits. Hopefully we can also look forward to less congested traffic systems and less pollution in urban areas. With that in mind, we share some insights into the world of autonomous vehicles in this issue of Photonics News Nordic. Laser processing in the automotive industry? Check! Road side monitoring using laser spectroscopy? Well, of course! And as always, we share some interesting product news on the final pages.

I'd also like to encourage you to welcome Harvey Washbrook to our team – Harvey is our new Sales Manager and he will be happy to assist you with any inquiries you may have. As we continue to expand our activities in the Nordic region, Harvey will play an important role developing our business. Give him a call to set up a meeting and find out how our components can help yours.

When you're reading this, we have already finished the trade show "Elektronik 2019" in Sweden, and aim forward, towards "Optics and Photonics Days Finland" in Espoo, May 27th–29th. See you there!

Yours

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General Manager,
LASER COMPONENTS Nordic AB

Harvey Washbrook
Sales Manager

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e-mobility

E-Mobility Requires Lasers and Digitization

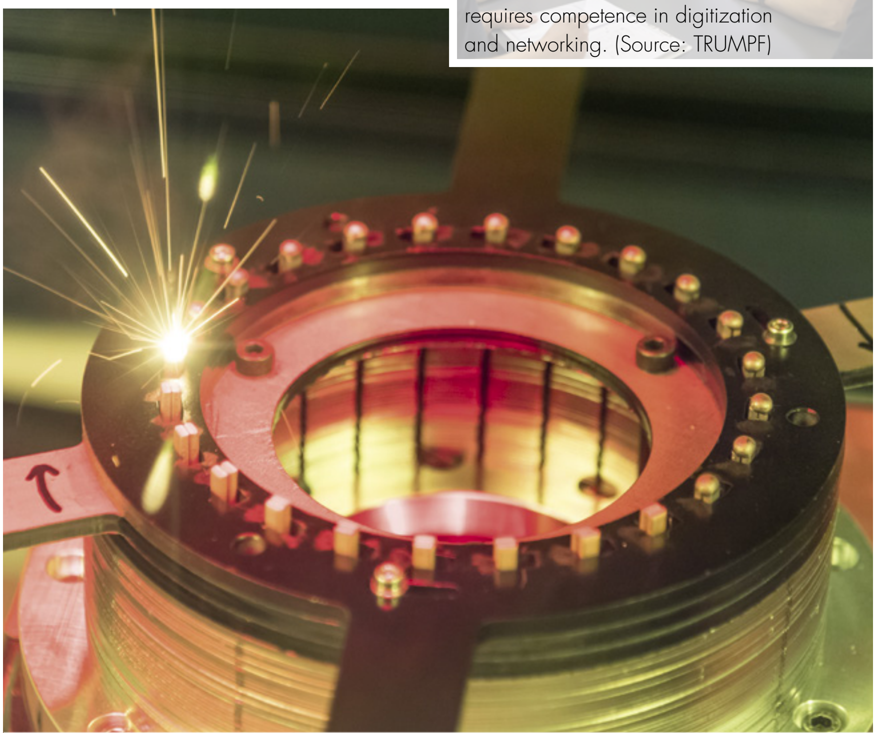
Electromobility is more than just a trend; it is on its way directly to the mass market. Companies such as the laser specialist TRUMPF see it as a great opportunity for both themselves and the industry because automobile manufacturers need innovative technologies for mass production. They require robust processes that can be quickly scaled from today's low production volumes to mass production. This calls for expertise in two areas: laser technology and digitization. Laser technology can efficiently and affordably manufacture the key components of electromobility, such as electric drives, power electronics, and batteries. Digitization is necessary to meet the production requirements of the automotive industry – maximum utilization of capacity and maximum flexibility.

Electric mobility is on the rise worldwide. In 2017, more than one million electric cars were registered for the first time over the course of one year. This amounts to 57 percent more than in the previous year. China is the front runner with around 60 percent of all new registrations, followed by Europe and the U.S. Delivery services and logistics service providers all over the world are also converting their fleets to emission-free electric vehicles. Stringent emission standards and the demand for better fuel mileage suggest that the number of e-cars will continue to increase.

The growing demand for electric mobility is also becoming apparent at TRUMPF: every tenth euro of the Germany-based high-tech company's sales in the automotive sector can be attributed to battery production – and the trend is rising. "We have the right manufacturing processes in place to economically manufacture the central components required for mobility in the future: Only lasers can produce electric drives, high-performance electronics, and batteries in series so flexibly and at such a top level of performance," says Christian Schmitz, chief executive officer of laser technology at TRUMPF. ➔

New Hairpin Technology Reduces Cost of E-Motor

Automotive manufacturers are increasingly relying on so-called hairpin technology for electric motors. To generate a stable magnetic field, the stators (i.e., the immovable parts of an electric motor) are typically wound with copper wire. Each individual groove of the carrier unit is wrapped – the way a knitting needle is used. Due to the thick copper wires, this is too complex and time-consuming for strong electric motors designed to drive a car. In the hairpin process, a compressed-air pistol shoots preformed "hairpins" made of rectangular copper wire into grooves at the edge of the motor. The wires are then wound together and welded. The highest precision is required to maintain the electrical conductivity of the copper. Such clean and precise welds can only be achieved with lasers. "With our welding process for the hairpins, we ensure that electric motors can be manufactured quickly, safely, and cost effectively. The costly and time-consuming winding of coils with thick copper wires for strong electric motors is no longer necessary. This makes mass production considerably easier," says Schmitz.


Welding hairpins using TRUMPF laser technology (Source: TRUMPF)

"Green Technology" for High-Performance Electronics

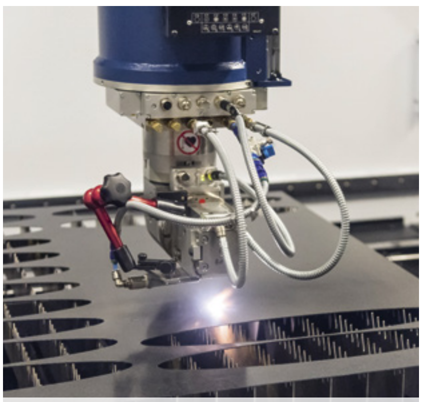
The designers relied on copper not only for the engine. While a 24-volt battery sufficiently powers the complete electronics of a combustion engine, voltages of around 800 volts are quickly generated in an electric car. To withstand this load, the designers use the excellent heat and power conduction properties of copper. However, the same capabilities of this metal also pose challenges: laser welding normally uses infrared radiation. But it is precisely in the wavelength range of around 1000 nm that copper exhibits highly-reflective properties. Depending on the surface condition, uniform weld seams can therefore only be guaranteed to a certain extent – and is oftentimes not high enough for industrial purposes. Deep penetration welding can also produce spatter that damages the component and, in a worst-case scenario, leads to short circuits on the boards.


For mass production of electromobility it requires competence in digitization and networking. (Source: TRUMPF)

TRUMPF has therefore developed a solution using a green laser. The green wavelength is absorbed much better by copper. Because the material reaches its melting temperature faster, the welding process starts more quickly and requires less laser power. While the infrared laser operates at 2.6 kilowatts of peak pulse power, the green laser uses 1.4 kilowatts for the same weld seam. This process is more energy efficient and produces significantly less spatter. This means that copper welds are always produced with consistent quality on every type of surface.

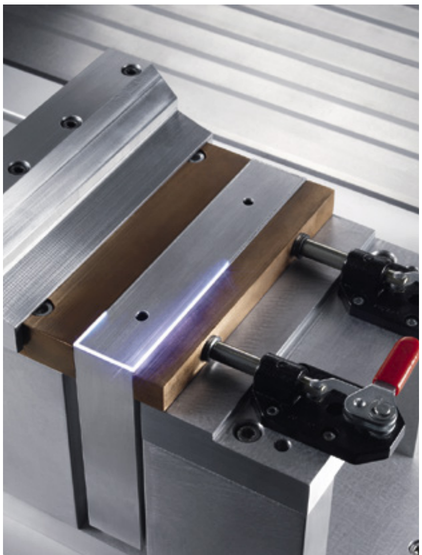
"In addition to factors such as the correct wavelength, laser optics also make a critical contribution to the precision of laser welding processes," explains Mike Tuohy, sales engineer at LASER COMPONENTS USA. "They bundle the laser beam with all its energy onto a small spot. Due to the high energy of industrial lasers, a high laser damage threshold is a crucial factor. For special requirements, DOEs can be used to implement a wide variety of beam shapes."

With these and other laser processes for electronic components, all 200 or so welds of an electric motor can be performed in just over a minute. The charger plug, current transformer, and rectifier are examples of the range of new power electronics being introduced into the car.


Laser technology processing of key electromobility components. (Source: TRUMPF)

Digitization for Secure Battery Production

In addition to the production of motors and electronics, laser technology also plays a crucial role in the production of batteries. In this area alone, TRUMPF has already sold more than 500 lasers. The batteries consist of several layers of wafer-thin copper and aluminum foils, which are cut with the laser. The battery is then filled with liquid electrolyte and welded shut with a lid. These welds must be tightly sealed: if the battery breaks down during operation, there is a risk of fire and injury. From the battery cell via the battery module to the battery pack, the laser takes over all welding processes. The laser systems have sensor systems and are connected to a cloud solution via software. The sensors provide values for quality assurance and documentation but also control the welding process.



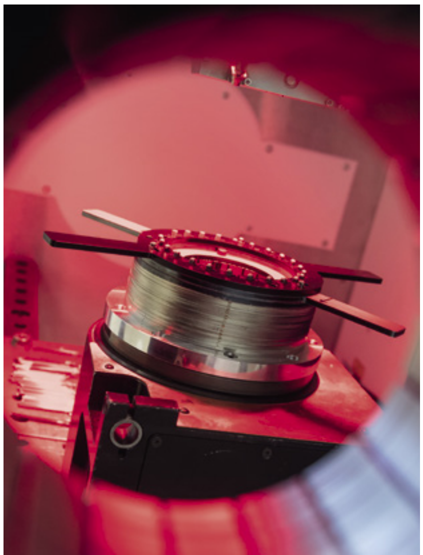
Laser welding a battery housing for a single cell in a battery block for electric cars (Source: TRUMPF)

Battery production requires not only know-how in laser technology but also in digitization. This is because process monitoring is an important basis for stable production, especially in battery production for electric cars. "Battery manufacturers are faced with the problem that they can only test the functionality of the battery at the end of the production process. They need continuous monitoring of this process to ensure that the battery functions properly at the end of the process," says Schmitz. In addition, digitization can generate data that is of interest to the end customer, including performance data, speed data, and sensor data that lists both the welding result and the seam width.

With this data, the manufacturer can document the quality of production, detect deviations from the standard, and intervene at an early stage. In addition, manufacturers are increasingly relying on maximum flexibility in their systems. They produce different types of engines – both internal combustion engines and electric cars – on one and the same production line. This flexibility can only be achieved if systems are digitized and intelligently networked.

Not Only Cars Drive Electric

The market potential of electric mobility is only just beginning to fully unfold because mobility via electric traction drive means more than just electric cars. Fully electric trucks with overhead lines are currently undergoing practical testing in Sweden and Germany; in Norway, the first strictly battery-powered passenger and car ferries are already in operation; in many parts of the world, municipalities are relying on electric street cleaning and gritting vehicles; the first fully electric tractors are already quietly plowing furrows through fields; bicycles supported by an electric motor have enjoyed growing popularity for years; and electric scooters are a market with millions sold per year, especially in East and Southeast Asia. All these e-vehicles require batteries, power electronics, and electric motors. ■



TRUMPF laser technology for efficient mass production of electric motors. (Source: TRUMPF)

On the Road to Self-Driving Cars

My Car and How It Sees the World

In the world of science fiction, self-driving cars are practically standard vehicles. In "real life," we are catching up fast with authors' imaginations. Even today, it seems as if a new warning system is being added every year. Lane departure warning systems and distance and parking assistants are already available in mid-range cars. At least in stop-and-go mode, higher-priced models practically drive themselves. Does that mean commuters have time to take a little nap in the daily morning traffic jam? The technology is not quite there yet, but there is real competition among car manufacturers on the road to autonomous driving.

Whenever this automotive future begins, one thing is certain: so-called vehicle-environment sensor technology will play a major role in achieving this next step because in order to independently steer through traffic, the vehicle must be able to keep an eye on its surroundings at all times. Many of the solutions are already being used in assistance systems today. There is astonishing technological diversity because each of the measurement principles used has its advantages and disadvantages. The spectrum ranges from electromagnetic to acoustic to numerous different optical systems. As an outsider, you can lose track of these innovations: ➔

A Bat in the Car?

Locating objects and navigating by ultrasound has been seen before in nature. The most well-known example is bats. They emit ultrasonic waves and can recognize prey and obstacles by means of a reflected echo. Their maximum range is around twelve meters. The ultrasonic sensors used in cars function according to the same principle. The problem is that the artificially generated sound waves also have a comparatively short range; therefore, they can only be used at close range. The most well-known applications are distance meters for parking assistants.

The first models with this assistance system came onto the market in the early 1980s. Ultrasonic technology is now not only used at the rear of the car but with blind spot sensors or to measure the distance to the vehicle ahead at low speeds as well. In addition to the short range, engineers must also deal with external interference factors when developing ultrasonic-based assistance systems. The hydraulic brakes of trucks and buses, for example, also generate ultrasonic waves, which can cause acoustic confusion in sensors in the immediate vicinity.

A Car with Eyes

Camera systems probably come closest to imitating human perception. A camera installed in the car continuously records the vehicle's surroundings while in motion. Software interprets the data. It recognizes, for example, edges that might mean other vehicles or lane markings. As the resolution of cameras increases continually, more and more details can be evaluated. This enables the system to detect not only obstacles but traffic signs or traffic lights as well. This information helps to prevent accidents and contributes to orientation because the camera also recognizes details that are not recorded on the digital maps of common navigation systems.

There are two main problems with camera-based systems: the lack of three-dimensionality and the limited viewing angle. A single camera reduces the three-dimensional world to two dimensions. In an environment like street traffic, where there is a lot of movement, this can lead to a misinterpretation of data.

A person intuitively knows that objects appear larger as they come closer; however, a computer must first learn these correlations. It is also possible that an object becomes larger and larger at the same distance. In addition, the camera's field of vision is limited. While other systems with wide sensor beams scan the world, it can only ever look forward. A pedestrian who suddenly runs onto the road is often only recognized shortly before a collision. Both disadvantages can be overcome by using several cameras simultaneously, possibly with different focal lengths.

RaDAR or LiDAR?

RaDAR and LiDAR do not just happen to have similar "names." They are both used in detection and ranging; like ultrasonic detection, they are based on the analysis of reflected waves – except that in one case the waves are RAdio waves and in the other case LIght waves. This results in some differences, which are significant with respect to automotive sensors: ➔

Transmitter and Receiver from a Single Source

WEB N10-041

LiDAR systems should be reliable, small, and cost effective at the same time. For manufacturers of laser-based measuring devices and optoelectronic components, this is a great challenge.

LASER COMPONENTS manufactures all components for powerful and future-oriented LiDAR solutions in its ISO-certified production facilities: pulsed laser diodes with ultra-short pulses provide better resolution for distance measurement. In combination with highly-sensitive avalanche photodiodes (APDs), even the smallest signals can be detected.

In addition, there is a cooperation with the Fraunhofer Institute for Microelectronic Circuits and Systems (IMS) for 1-dimensional and 2-dimensional CMOS-SPAD arrays. The researchers from Duisburg can contribute new sensor technologies that promise particularly precise measurements. ■

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Radar: Frequency-Modulated Continuous-Wave (FMCW) radars, in which the frequency of the electromagnetic wave is constantly modulated in the form of a ramp, are commonly used in environment recognition. Using the doppler effect, the distance and speed of an object can be determined from the propagation time of the wave and the frequency difference of the reflected wave. To determine the position of an object, several antennas are arranged in crescent shapes. However, the lobes of the individual antennas are comparatively wide, which results in overlap. This gives the impression that the object jumps back and forth between the individual sensors. Radar does not provide any information about the size or shape of an object.

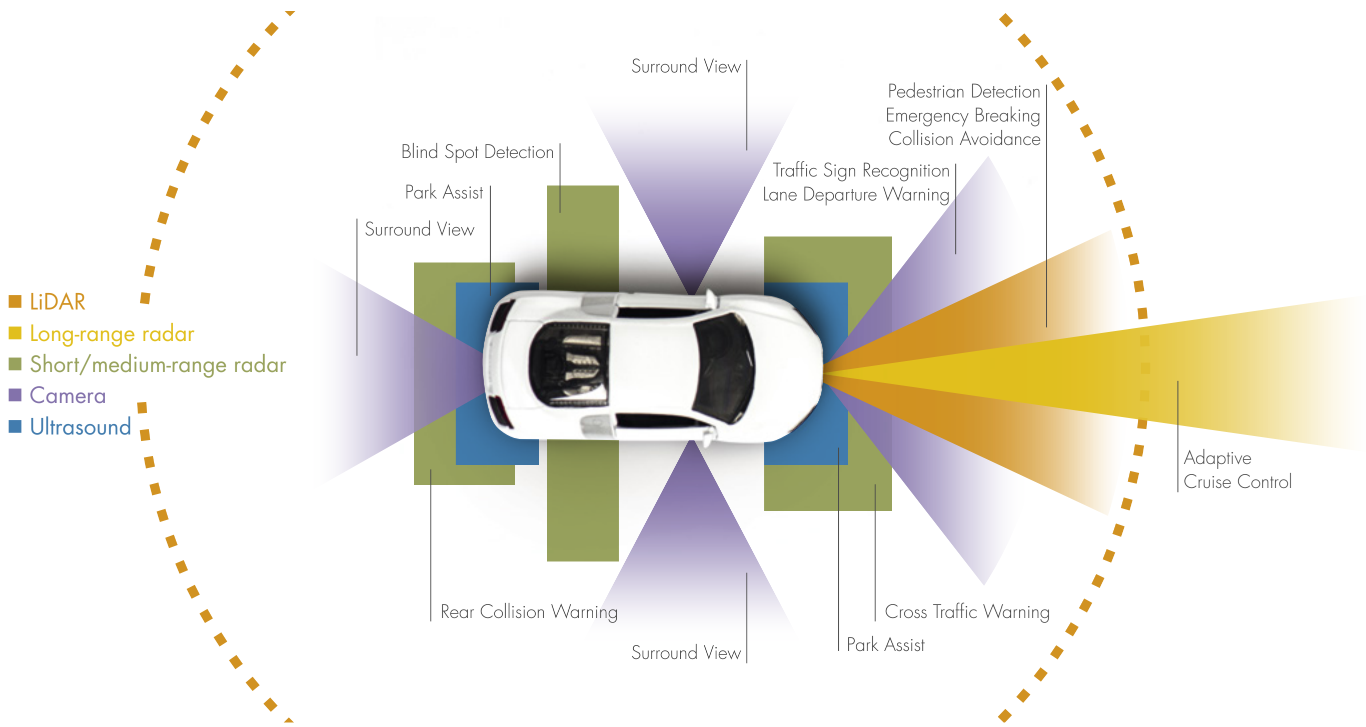
LiDAR: LiDAR measurements emit several thousand laser pulses per second. Each pulse lasts only a few nanoseconds. The distance to the obstacle can be determined by the difference in transit time between the outgoing signal and the incoming reflection, the so-called time of flight (ToF). Since pulsed laser diodes emit their beams at an interval of a few nanoseconds and – as we all know – nothing is faster than light, LiDAR provides reliable information in the shortest possible amount of time. Compared to other systems, however, the scanning field of a single transmitter-receiver unit is limited.

Looking for optimal field of view, different scanning systems are being evaluated, either mechanical or solid-state. The mechanical scanning systems use a rotating mechanism, galvo-mirrors or MEMs while solid-state systems use waveguides, phased arrays or meta-surfaces. There are a few new systems using the same FMCW method as in radar to obtain velocity and distance information in a return optical signal.

The LiDAR method works considerably faster than the radar method and provides a greater amount of precise data. Yet, the design of the LiDAR instrument has to consider atmospheric limitations like fog, smog and solar radiation. To solve the scanning and atmospheric conditions, each LiDAR method can optimize laser output power, change laser wavelength and radar frequency, or use multiple laser and detector arrays. The end result is to obtain object detection at greater than 300 meters in every conceivable driving condition.

Strength in Numbers

With automated – now referred to as autonomous – driving, nothing may be left to chance. While a human being can intuitively draw on his wealth of experience and intuitively react to situations, a computer must constantly make new decisions. To do this, it needs as much data as possible. Each sensor system can contribute to this decision with its specific advantages and disadvantages. There are prototypes that are only equipped either with cameras or exclusively with LiDAR. Most automobile manufacturers, however, rely on solutions in which several of the above-mentioned technologies are used simultaneously. This fusion enables them to make optimum use of the strengths of each process and benefit from synergistic effects. ■



Roadside Monitoring

Tuning Down Pollution

It took less than a century for cars to become an indispensable part of our modern lifestyle. They keep us mobile and take us to faraway places. For many of us, even routine affairs such as the daily commute would be unthinkable without cars. But the flip side of the coin has become as obvious as the advantages: Vehicular air pollution affects air quality in both metropolitan and small-town areas all around the world. Stratospheric ozone depletion and global warming are among the most pressing issues of our time.

Throughout Europe, politicians and scientists have been discussing a diverse range of measures to limit exhaustion of CO_2, greenhouse gases, and particulate matter. In some cities, only cars with even numbers may drive on even-numbered days, while elsewhere people must pay considerable fees to get admittance to city centers. In Germany, recent considerations about diesel bans have created an uproar but also increased the general concern about environmental affairs.

More Realistic

In 2015 experts from the European Union, Japan, and India agreed on the Worldwide harmonized Light vehicles Test Procedure (WLTP) following the guidelines of the UNECE World Forum for Harmonization of Vehicle Regulations. Any new model pro-duced after September 2017 must comply with these regulations. In addition to the usual lab tests, cars must also undergo a so-called Real Driving Emissions (RDE) test following clearly-defined statistical guidelines. Some pollutants, such as nitrogen ox-ides (NOx), cannot be determined under lab conditions but need to be tested in a driven car. Therefore, the RDE test will certainly deliver more accurate and extensive results. Some scientists, however, state that the bulky equipment commonly used for RDE testing leads to unreliable results because it changes the aerodynamics and weight of the car. Instead, they propose TDLAS systems that would easily fit into the trunk of the car. Their detection units could be attached to the exhaust pipe without any convoluted constructions.

Controls for used cars have also been streamlined. After a maximum period of four years before the first check-up, every car must periodically undergo a vehicle inspection, which includes an emissions test. In most European countries, these checks are conducted every two years. Following these regulations, there is a certain need for every car on the road to meet governmental standards. Outside the EU, the picture is a little bit more confusing. In Canada and the US, for example, regular vehicle and emissions tests are part of provincial or state legislation. The Clean Air Act of 1990 merely requires the implementation of vehi-cle emissions inspection programs in metropolitan areas where air quality does not meet federal standards. Therefore, there are virtually fifty different regulations within the US; sparsely populated states like Wyoming and Alaska do not feel the need for any inspection whatsoever.

Fixed Spots

In many cities around the world, pollution measurements are also conducted by fixed metering stations. The concentrations of pollutants such as SO_2, H_2S, CO, NO, NO_2 or ozone are monitored on a 24-hour basis, often using a different method for each substance. Sulfur compounds may be measured using UV fluorescence, NO_x values are determined by chemiluminescence, and CO is determined by IR absorption. This is a useful strategy to obtain an overview of the overall pollution. These stations do not differentiate between vehicular, industrial, and domestic pollution but provide an overview of the overall air quality at a spe-cific point and time. Many of them are placed in heavy traffic areas; it can, therefore, be concluded that variations of certain pollutants are mainly caused by vehicle emissions. These stations are the main source for pollution values as commonly mentioned by the media. According to the Umweltbundesamt (German Federal Environmental Agency), the overall air pollution has decreased each year by 5% compared to 1995.[1]

Roadside Measuring

It appears that European countries have finally found a way to keep track of their pollution and started taking measurements. But the lion's share of worldwide CO_2 emissions is created outside Europe. The fast-growing industrial economies of China (29.1% of worldwide emissions) and India (6.98%) are among the top five. In 2014, the WHO declared New Delhi the dirtiest city in the world regarding particulate matter. The concentration was about ten times higher than that of the European metropolises of London and Paris. To cope with these problems, Indian scientists have come up with a reliable, cost-effective, and easy-to-use method for roadside measurement of vehicular emissions:

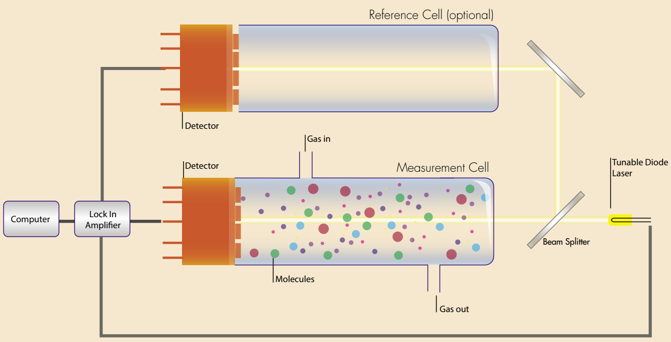
At the LASER COMPONENTS **IR WORKshop** in 2016, Dr. T.K. Subramaniam of the Department of Science & Humanities (Physics) at Sri Sairam Engineering College in Chennai, India proposed a laser-based method that would allow the in-situ roadside measurement of all pollutants in a single scan. He applied Tunable Diode Laser Absorption Spectroscopy (TDLAS), which builds on well-known spectroscopic principles and uses sensitive detection techniques, coupled with tunable diode lasers and optical fibers developed by the telecommunications industry.

1 https://www.umweltbundesamt.de/daten/luft/luftschadstoff-emissionen-in-deutschland

TDLAS

WEB N10-032

Tunable Diode Laser Absorption Spectroscopy (TDLAS) is a sensitive detection method that uses a tunable laser diode to determine not only the existence, but also the concentration of a substance in a medium. According to the Beer-Lambert extinction law, the amount of attenuation in a light pulse depends on the concentration of the absorbing molecules and the path length over which absorption occurs. As light traverses a medium containing an absorbing analyte, decreases in intensity occur as the analyte becomes excited.



This means that for a given path length attenuation increases with the concentration of absorbers. Semiconductor lasers can be tuned in wavelength to match distinctive absorption lines.

By transmitting a beam of light through a gas mixture containing a (usually trace) quantity of the target gas, tuning the beam's wavelength to one of the target gas's absorption lines, and accurately measuring the absorption of that beam, one can deduce the concentration of target gas molecules integrated over the beam's path length. This measurement is usually expressed in units of ppm-m.

LASER COMPONENTS supplies detectors, optics, and lasers to manufacturers of specialist TDLS equipment. ■

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Dr. Subramaniam proposes the use of TDLAS measuring systems (see box) for the roadside monitoring of exhaust gas emissions. To get results that reflect the average pollution rate of a car, measurements must be made at a time when the engine has been running for several minutes. The catalytic converters usually need three to five minutes to reach their operating temperature, during which time carbon monoxide and unburned hydrocarbons are released into the air. The emission of nitrogen oxides also increases with the motor load. Measurements, therefore, will have to be conducted on road sections on which cars are indeed driven. According to Dr. Subramaniam, highway intersection ramps and toll plazas would be the best spots for roadside exhaust controls. "At intersections, the motor has been running for a considerable amount of time; driving uphill puts additional strain on the combustion system. The ramps could, therefore, be used to check the emissions and environmental effects of each vehicle. At toll plazas, a number of instruments could be used simultaneously when the vehicles are at "idling condition" after running through long distances. In these places, it may be possible to add supplementary sensors to capture vehicle payload and other values that affect emissions", says Dr. Subramaniam. "If the vehicle being tested is found to have emissions which violate the rules of the day as prescribed by a government of the day, a high-speed camera is activated within a microsecond or a picosecond to take a photograph of the license plate of the vehicle and the driver of the vehicle, as well as to note other details like the time and place of booking, etc. The driver will then be notified that his car needs maintenance. In grave cases, tough consequences could be implemented. If the car complies with regulations, the driver receives a badge showing proof of suc-cessful control." He is convinced that "TDLAS is a fool-proof method to detect and control vehicular emission. Remote sensing instruments can measure the emissions of thousands of vehicles per day."

Some US states follow a similar strategy by conducting mobile roadside emission tests – not unlike speed traps or alcohol tests. Experts state that compared to station-based tests, roadside controls can check thousands of in-use vehicles under real-life conditions. The data collected "on the road" could be used to improve government or manufacturer programs. For example, they could be used to find out builds or models with particularly high pollution rates and thus help discover design flaws. ■

Dr. T.K. Subramaniam has been working as a professor of physics at Sri Sairam Engineering College, Chennai, India for more than twelve years. As a renowned specialist in the field of laser spectroscopy, he has twenty-nine years of experience in research and industry. In 2004, he earned his PhD from the famous Banaras Hindu University (BHU) in Varanasi, India, where he also helped to establish a laser spectroscopy laboratory. His work includes twenty-three research publications in international journals of repute and a textbook on Engineering Physics recently published by the Oxford University Press (OUP). He also serves as a peer reviewer for the Optical Society of America (OSA) group of journals, i.e., the Journal of the Optical Society of America and Applied Optics. ■

New Products

Protection Class IP67

Laser Module ILM12IP is Dustproof and Waterproof

WEB N10-074

The FLEXPOINT® ILM12F laser module has always been robust; and now the ILM12IP version is virtually indestructible. This new housing complies with protection class IP67. This means that even the finest dust cannot penetrate it. It is also safe from exposure to water. Half an hour of submersion does not affect it. TÜV tests according to DIN-EN 60529:2014-09 have confirmed this.

All in all, this means that the ILM12IP can easily withstand the weather conditions at construction sites or outside facilities.

With its M12 external thread made of stainless steel, it can be screwed in and connected quickly and easily. This makes it the perfect tool for aligning machines, for adjustment work, and for positioning (e.g., when aligning a drill with a workpiece).

The module is available with a green (520 nm) and a red (635 nm) laser. The focus of the IP version can be set at a fixed distance or collimated. ■

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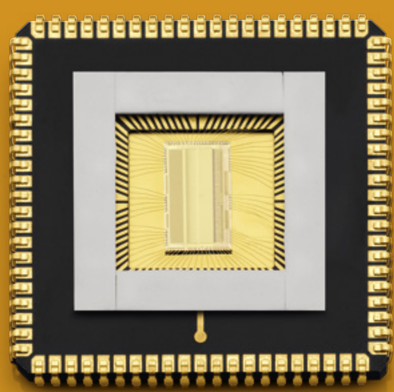
Detector for Flash LiDAR systems

SPAD Arrays expand Product Portfolio

WEB N10-035

Conventional LiDAR scanners use a failure-prone mechanism with rotating mirrors. Flash LiDAR technology, however, uses highly-sensitive 2D single-photon avalanche diode (SPAD) arrays. With a resolution of 2 x 192 pixels and noise < 50 cps, these components are around 10^6 (one million) times more sensitive than the photodiodes integrated in smartphones, for example.

Unlike classic LiDAR, the arrays do not detect just one point; each individual pixel provides information on the position. In addition, the sensor and evaluation electronics have been mounted on the same chip for the first time. This makes this new development particularly space saving. For example, car manufacturers could install it behind windshields or headlights. ■



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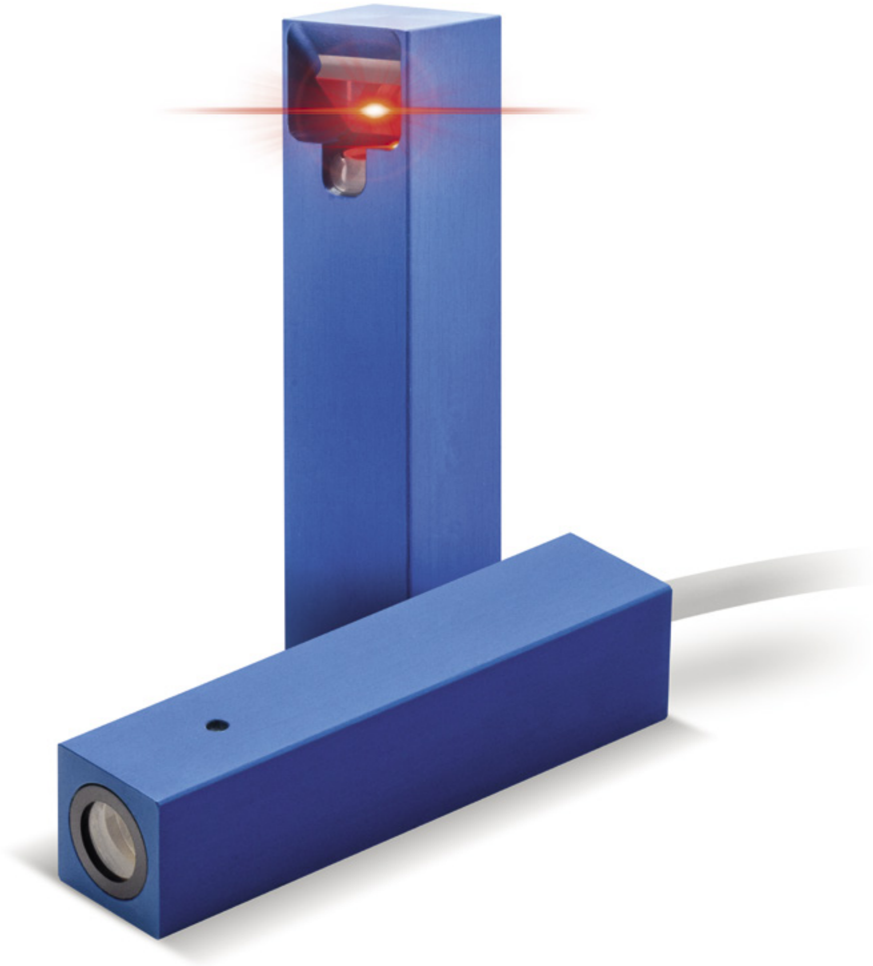
FLEXPOINT® MVsquare Line Laser Module

No Cares! Be Square!

WEB N10-174

One major challenge in the series production of 3D sensor systems for industrial image processing is the fine adjustment of the line laser. Focus and beam position must be set correctly for each individual module. The MVsquare offers a remedy for this: Its rectangular housing serves as a clear reference surface for the alignment of the line during installation. All parameters are set at the factory according to customer specifications and the module can be integrated without further adjustments. Since mechanical elements such as the focusing mechanism are not required, the customer can be sure that all parameters remain unchanged even after installation.

For applications in which every millimeter counts, the MVsquare is also available in a version in which the laser beam is deflected by 90° and exits the side of the housing. This saves considerable space in the z-axis, especially when installed in small sensor housings: Instead of the total module length of 65 mm, it is only necessary to reserve 15 mm. Nothing changes in the beam parameters. ■



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Laser Light – When Randomness Is Desired

Truly Random Patterns

WEB N10-274

The FLEXPOINT® MVstereo laser module was developed for 3D stereo image processing, in which three-dimensional structures are calculated from pixel information. For this purpose, the module projects a randomly arranged cloud of dots onto a surface. In addition to the "pseudo-random patterns" previously used, "truly random patterns" with 31,806 or 47,708 dots are now also available: Repetitions do not occur with these patterns – not even with partial patterns.

The range of pseudo-random patterns has also been extended: Versions with 40,100 and 29,594 dots are now also available. Due to the different number of dots and the different fan angles of the patterns, customers can choose the optimal optics for their application.

Such projectors are used in the recognition of gestures and in volume and depth measurements. ■

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Individual Fiber Tips

We develop your solution!

WEB N10-021

In-house production: Customized fiber tips for your applications!

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- Spherical lenses
- Grin lenses - also as assemblies with connectors
- Endcaps for PM fibers and high-power assemblies; also within free-standing connectors

Quality Assessment of the Laser Beam with Beamage-M2

Fast and Easy M^2 Measurement

WEB N10-071

The beam quality factor M^2 describes the difference between the divergence angle of a laser beam and the ideal Gaussian beam. The smaller the value, the better a laser can be focused.

With the Beamage-M2, Gentec-EO has now introduced an automated system that performs an M^2 measurement according to ISO11146 and ISO13694 specifications in just 20 to 60 seconds. The detector is a particularly large CMOS sensor chip (11.3 mm x 11.3 mm) with a resolution of 4.2 megapixels. It is the only M^2 system equipped with a complete set of 50 mm optics and is therefore also suitable for larger beam diameters or divergence angles.

Two adjustable deflecting mirrors ensure that the laser beam can be adjusted easily and flexibly. The beam path is "folded" 180 degrees inside the device via two factory-set deflecting mirrors. This enables 400 mm of travel of the optical axis and requires a minimum amount of space at optimized speed. With its handy design, the Beamage-M2 can be easily mounted on optical tables. This makes it ideal for use in R&D laboratories. Automatic and manual measurements are possible via user-friendly software. ■

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