PHOTONICS NEWS

Company Newspaper of LASER COMPONENTS (UK) Ltd

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#66 ▪ 04|2021

BIO & AGRICULTURE

Longer Life Oranges

Optical Oil Analysis

Precise Crop Fertilisation

Atmospheric LiDAR

New Products

Discover our new SEMICONDUCTOR DETECTOR FACILITY

CHANDLER arizona
Community of Innovation

29k facility sq.ft.

CLASS 10,000 clean-room

1 shift

3 shift

14 cacti 5 adults

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ANSI/ESD S20.20

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Canteen
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Imprint

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Dear Colleagues

A year on and every day there is still talk of the pandemic but some light at the end of the tunnel with the vaccination roll out and the UK appears ahead of other nations so we should see return to normality first. It still means as a business we continue with our long-term LASER COMPONENTS Group plans and one such project recently completed is the new production facility in Chandler Arizona. With construction remaining on target throughout the pandemic, completion ended on time last September for this 2,700m^2 factory with ISO 7 Class 10,000 cleanrooms that will support 80 employees or 200 on 3 shifts. Specifically designed and equipped for the manufacture of avalanche photodiodes and IR detectors such as lithium tantalate and DLaTGS pyro-electric and lead-salt detectors, this state-of-the-art facility will keep LASER COMPONENTS on track for its global plans.

Other projects include the investment of a new ion beam sputtering coating machine at our Munich factory to increase production of ultra-high quality laser optics with high laser damage threshold dielectric coatings. We included additional in-house CRDS (cavity ring-down spectroscopy) measurement capability and with reference mirrors we can verify coating absorption levels of R>99.995% at 1064nm, with 532nm and 355nm planned.

Our single photon counting modules, COUNT, now have a new characterisation station to simultaneously verify multiple units and at various wavelengths.

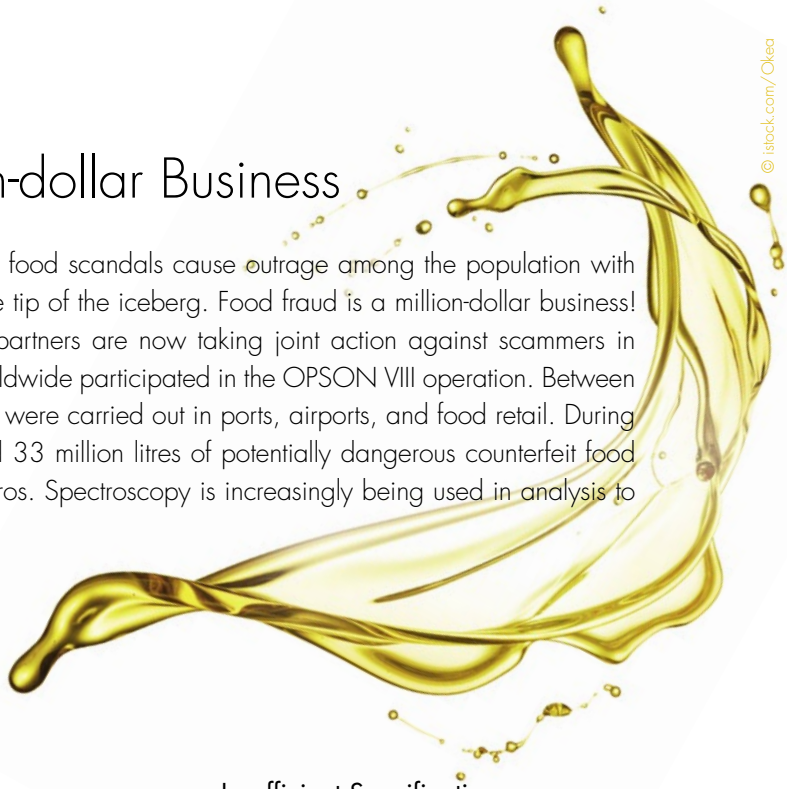
Step by step we increase our productivity and enhance performance of our products, as well as the introduction of new products when customers make strong requests. We also have additional products from our many valued supplier partners. The strongest business cooperation with our supplier partners extends many decades. Our partnerships aim is to offer our customers components that complement each other to bring winning solutions and gain new market share. Please do let us know of any exacting requirements you have, and we shall explore the possibility to add these to our road-map.

Meanwhile, keep safe and I hope when we publish our next newsletter there is evidence the pandemic is slowly being beaten and we can once again meet in person at tradeshows and other venues.

Yours sincerely,

Chris Varney
Managing Director, LASER COMPONENTS (UK), Ltd.

Food Counterfeiting – A Million-dollar Business



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Glycol in wine, motor oil in olive oil, horse meat in lasagne – food scandals cause outrage among the population with uncanny regularity; however, these major scandals are only the tip of the iceberg. Food fraud is a million-dollar business! Police, customs, national food authorities, and private-sector partners are now taking joint action against scammers in coordinated campaigns. Representatives from 78 countries worldwide participated in the OPSON VIII operation. Between December 2018 and April 2019, more than 67,000 controls were carried out in ports, airports, and food retail. During these inspections, investigators seized about 16,000 tons and 33 million litres of potentially dangerous counterfeit food and beverages with a total value of more than 100 million euros. Spectroscopy is increasingly being used in analysis to detect the counterfeits.[1]

On the Trail of Counterfeiters

Spectroscopy in Food Safety Applications

There is hardly a foodstuff that counterfeiters do not use to scam customers. They have various tricks, the most common of which is to mix high-quality varieties with cheap alternatives to increase profits. The best-known example of this is certainly the horse meat scandal of 2013; however, scam artists also like to use this method for fish. There is also often cheating when it comes to information on geographical origin and production methods because if conventionally produced cheaper goods are sold as organic products, there is a great deal of money to be made. A third widespread way to mislead the consumer is to give false information about ingredients. For example, if it says on the packaging that a product is rich in omega-3 fatty acids, then these should also be found in the contents.

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Criminal Manipulation

At the top of the counterfeiters' popularity list is olive oil. A veritable cult has developed in recent years around the "extra virgin" quality seal,

> Everything from label fraud to brazen forgery is included.

and consumers are prepared to dig deep into their pockets for high-quality oil. Counterfeiters have the potential to yield high profit margins and are for the most part truly audacious. In May 2019, a counterfeiting ring was discovered in Italy that makes around eight million euros in profits every year; however, the product had very little to do with olive oil. Rather, the oil sold was cheap soybean or sunflower oil, to which chlorophyll and artificial flavourings were added in order to achieve the characteristic colour and spicy-bitter taste of olive oil. Every few weeks, over 20,000 litres of the adulterated substance were delivered to restaurants and stores in Germany. The production cost just 1.20 euros per litre. The oil was sold for 5 to 10 euros.[2]

Insufficient Specifications

The quality criteria for olive oil were established early on throughout Europe. In the directive EC 2568/91, the EU also recommends various methods of analysis. However, the procedure proposed in the directive has a crucial disadvantage, according to Dr. Christian Gertz from the Maxfry company: "The standard methods listed in the directive are limited to identifying certain markers that indicate manipulation. Counterfeiters are also aware of these criteria and can adapt their products to meet the limit values. Furthermore, other deceptive practices such as false declarations of origin cannot be detected. A high level of security can only be provided by a solution that evaluates a sample in its entirety."

> Olive oil without a single olive.

Molecular Fingerprint

The Maxfry company, which is located in Hagen, North Rhine-Westphalia, Germany, has developed a process that detects manipulated olive oils with a probability of over 95% – and in a very short time. The basis for this information is provided by data collected with a Fourier transform NIR spectrometer from the Bruker company. Most molecules absorb light in the

1 https://www.europol.europa.eu/newsroom/news/over-%E2%82%AC100-million-worth-of-fake-food-and-drinks-seized-in-latest-europol-interpol-operation
2 https://www.foodsafetynews.com/2019/05/authorities-bust-criminal-ring-dealing-in-yellow-gold-aka-fake-olive-oil/#more-184065

infrared region of the electromagnetic spectrum and convert this energy into molecular vibrations. Since each molecule is constructed differently and has characteristic vibrations, different ranges of IR radiation can also be absorbed. A spectrometer measures the absorption as a function of wavelength and can thus create a "molecular fingerprint." This makes it possible to precisely determine numerous organic and inorganic compounds. For a long time, this method was very complex because each wavelength had to be evaluated individually. This changed with the advent of FTIR and FT-NIR spectroscopy: with these spectroscopic methods, light is guided via continuous broadband sources first through a classic Michelson interferometer and then through the sample. The detector first outputs an interferogram in which all the components of the different wavelengths are summed. This contains all the spectrometric information about the sample. In order to determine the information of the individual wavelengths, the Fourier transformation is performed. This complex calculation is done by a powerful computer, which simultaneously analyses the spectrum using calibrations. An instrument like the Bruker MPA thus provides all the key figures for a detailed evaluation of the tested olive oil within a very short time.[3]

FT-NIR analysis works fast and reliably.

Complex Evaluation

The taste and quality of olive oil depend on a complex interaction of many factors. One of the most important aspects is the content of free fatty acids. Immediately after harvesting, this content is very low in the olives (approx. 0.1%). Due to biochemical processes, the value increases relatively quickly during storage. It is best if the fruits are pressed immediately after the harvest and contain few free fatty acids. Furthermore, the ratio of glycerides can be measured. The proportion of 1,2-diglycerides is above 90% immediately after harvest and decreases during storage because the substance is converted into 1,3-diglyceride during the production of free fatty acids. Another important factor is the peroxide number. A high peroxide value is considered an indication of natural, unrefined oil. In addition to these three examples, Maxfry's experts evaluate numerous other factors, such as fat composition and iodine content. They compare the criteria determined with the reference data of over 100,000 known samples. It is not the individual markers that is crucial here but rather their complex relationship to one another. This makes it possible to not only determine the various taste nuances (fruitiness, bitterness, spiciness, and the harmony of these three aspects) but also to make a prognosis about the origin of the oil tested. At the end of the analysis, manipulated olive oils can be identified at a rate of accuracy of more than 95%. In addition, quality, sensory profile, and defects are categorised according to international limits. Thanks to FT-NIR spectroscopy, the necessary data is available after a single measurement process that takes less than two minutes.[4] ■

3 https://www.youtube.com/watch?v=QKKfAAA7Ztg
4 https://www.maxfry.de/fileadmin/maxfry-downloads/EN/NIR_Report_Maxfry_example_EN.pdf

"May it seem to rain forever,
at some point the sky will run out of water."

(German Proverb)

No Rain, No Farming

Agriculture cannot thrive without rain. For a long time, this has sounded like a truism, but it is gaining new meaning with the increasing threat of global warming. The study of water in the atmosphere is becoming more and more important. Scientists are not limiting themselves to the obvious accumulation of water in the clouds. The water vapour in the upper layers of the atmosphere has also become the subject of research. It is a major cause of the so-called "greenhouse effect," which, on the one hand, ensures that our planet remains habitable. On the other hand, there is the danger that the atmosphere can heat up so much due to a "feedback effect" that the Earth will be transformed into an uninhabitable wasteland. With powerful LiDAR methods, researchers aim to unlock the secrets of water vapour. ➔

Good Atmosphere

Sophisticated LiDAR Telescopes Measure Water Vapour

The natural greenhouse effect has always determined our climate and played a significant role in making our planet habitable. The average temperature on the Earth's surface is currently a rather pleasant 14 °C, which creates optimal conditions for various vegetable and animal life to prevail. This effect is caused to a large extent (approx. 60 %) by the water vapour contained in the atmosphere. Together with other gases like carbon dioxide (CO_2) and methane (CH_4), it reflects the heat radiation of the planet and prevents it from "disappearing" into space. Without this effect, the average temperature on Earth would be around -18 °C. However, water vapour plays another crucial role in the greenhouse effect, i.e., the so-called water vapor feedback effect. This refers to the effect by which the warmer the Earth's atmosphere becomes, the more water vapour it can absorb. This increases heat reflection, and the atmosphere heats up even more. Scientists assume that a similar "galloping greenhouse effect" occurred on Venus millions of years ago and was responsible for the average temperatures of around 440 °C that prevail today due to the particularly dense atmosphere of our neighbouring planet.

Water vapour backscattering must be avoided.

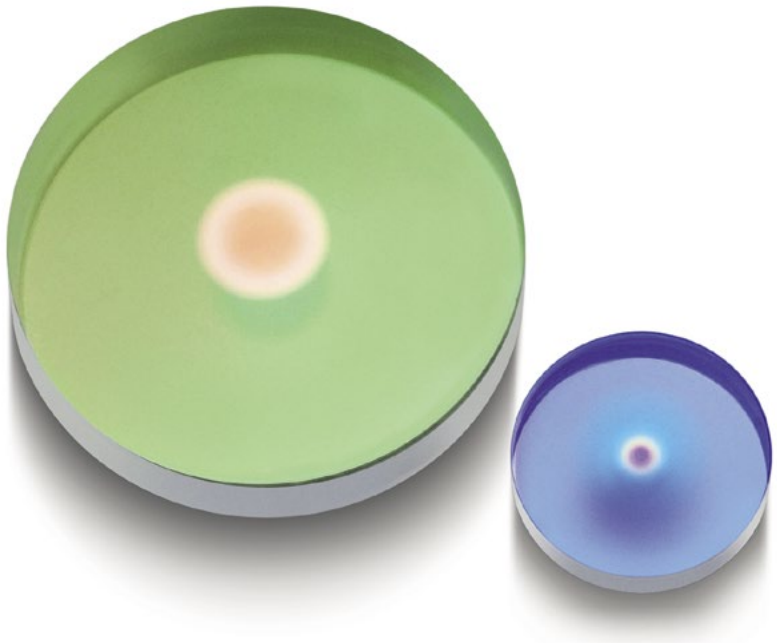
Specific Wavelengths

Therefore, it is more than understandable that scientists are interested in learning more about the water vapour in our atmosphere. For this purpose, they rely on optical methods such as differential absorption LiDAR (DIAL) and Raman LiDAR. Unlike the distance meters that are "commercially available", these two technologies are capable, among other things, of determining the concentration of certain substances. For this purpose, DIAL simultaneously sends two laser beams with closely adjacent wavelengths into the atmosphere. The first wavelength – the so-called "online wavelength" – is selected so that it can be absorbed as strongly as possible by the molecule to be measured. Its counterpart, the "offline wavelength," is absorbed as little as possible, and ideally not at all. It serves as a reference value for the measurement. From the difference of the reflected light components, information about the gas density of the molecule being searched for can be calculated. Since the wavelengths are exactly matched to the absorption behaviour of a specific molecule, this method can only be used to measure one specific gas (e.g., water vapour). In addition, general conditions such as the daytime temperature must be considered in the calculation.

Shifted Reflections

The second method is used to measure inelastic Raman scattering. A part of the light interacts with the molecules it encounters. Characteristic oscillations occur in the molecule that scatter the light back at a different wavelength. This so-called Raman backscattering is specific for each molecule and thus allows conclusions to be drawn about the molecular composition of a layer of air. Unlike DIAL, the Raman effect does not depend on the wavelength of the emitted beam. Therefore, essentially any monochromatic light source with enough power to penetrate the higher levels of the atmosphere can be used for this method. Furthermore, it must be considered that the Raman signal is significantly less intense than classic Rayleigh scattering. For these two reasons, short-wavelength lasers are preferred in research. They have both high energy and the effect that the Raman signal is more clearly visible at short wavelengths.[1]

Each gas has its own Raman signature.



1 https://de.coherent.com/assets/pdf/COHR_case_study_LIDAR_Zugspitze_Mountain_1218.pdf
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Uniform Course

The wavelengths for DIAL and Raman LiDAR are often generated by frequency doubling. For example, the frequency of an Nd:YAG laser that has a wavelength of 1064nm is doubled by interaction with nonlinear laser materials. This corresponds to a reduction in the wavelength by half to 532nm. The higher the intensity of the original beam, the better this transformation works. Therefore, Gaussian mirrors are often used to achieve high beam intensity and increase pump efficiency. These mirrors are also referred to as graded reflectivity mirrors (GRMs) because the degree of reflection decreases along a Gaussian curve from the centre of the optics to the edge. Accordingly, the beam has a high intensity once it has passed through the optics. GRMs are always used for the monochromatic light of a certain wavelength. LASER COMPONENTS manufactures standard Gaussian mirrors for the wavelength of 1064nm. Other wavelengths are available upon request.

Peak Performance

Since both methods have their advantages and disadvantages, the best results can be achieved with a combination of both. In Germany, several projects are currently underway for the long-term observation and monitoring of water vapour in the atmosphere. One of the most important measuring stations is located at the Schneefernerhaus directly below the Zugspitze summit at an altitude of 2656 metres. At this altitude, measurements are less frequently affected by clouds or fog. These moist layers of air would scatter the laser beam too much. Also, impairment due to environmental pollution and other particles – so-called aerosols – is considerably less in the comparatively clear mountain air. The Karlsruhe Institute of Technology (KIT) operates a powerful DIAL telescope on the highest mountain in Germany, which can carry out measurements up to a height of 12km. For this purpose, scientists use a tunable Ti:sapphire laser, which is pumped by a frequency-doubled Nd:YAG laser (532nm)[2]. For several years now, the facility has had a specially developed Raman LiDAR available, which is operated with a high-energy excimer laser (308nm)[3]. This system can even deliver values from heights of more than 20km. ■

Tested Quality

The production of Gaussian mirrors is very costly. The biggest challenge is the smooth transition in reflectivity. This is also the decisive quality feature of a GRM. Meticulous quality control is therefore much more important for these optics than for conventional mirrors and lenses. Therefore, this feature is examined in addition to the usual outgoing goods inspection.

The R&D department at LASER COMPONENTS has set up an automated measuring station to examine each Gaussian optic before it leaves the production facility. A continuous-wave laser scans the mirror along its diameter and thus documents the reflection values across its entire width. Only mirrors that meet the customer's specifications in all criteria are delivered.

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WEB UK66-0010

How Do Fruit and Vegetables Stay Healthy?

The quality control of agricultural products does not end with their harvest. This is especially true for fruit and vegetables that are not directly processed because the condition of the fruit changes during storage and transport. During harvesting, the fruit is separated from the plant, and therefore no longer receives water and nutrients. At the same time, more water is lost through evaporation: a decay process begins that makes the goods more susceptible to pests and ultimately spoiling. Researchers are looking for ways to assess the "state of health" of fruit and vegetables quickly and automatically in order to keep the yield of harvested food as high as possible. ➔

More Accurate than the Human Eye

Researchers Examine the Skin of an Orange

The mould *Penicillium digitatum* is considered one of the greatest enemies of citrus fruits. In many regions in which citrus fruits are grown, it is the main cause of spoilage during storage and transport and accounts for around 90% of all losses. It attaches itself to small damaged areas of the skin, through which water and nutrients escape. Initially, a soft spot develops on the surface, which resembles a pressure point. From there, white mould tissue spreads across the entire fruit, which eventually turns green as the fungus begins to form spores. In the end, all that remains of the fruit is an empty, dry skin.[1] A single infested orange can quickly spoil an entire crate. By the time the fungus has developed its white mycelium and is visible to the naked eye, it is already too late. That is why a method has long been sought to detect a fungal infection as early as possible. Researchers from the *Leibniz Institute of Agricultural Engineering and Bioeconomy* (ATB) in Potsdam and the *Valencian Institute of Agrarian Research* (IVIA) are now examining oranges using laser light.

One mouldy orange can spoil an entire crate.

Manual inspection is complex and subjective.

In Darkened Rooms

There are methods available for testing fruit with respect to defects, pests, and many other factors after harvest. One common method includes manual inspection, in which trained personnel examine each individual piece of fruit looking for certain characteristics. In the case of oranges, for example, examination is carried out in darkened rooms under UV light, which causes escaping essential oils to glow. This allows damaged fruit to be identified and sorted out. This process is just as time-consuming and laborious as it sounds. In addition, there is a risk that employees can be exposed to harmful UV light. You can also find out a lot about fruit and vegetables in a chemical laboratory; however, chemical methods are usually destructive. The fruit is destroyed in the process; thus, it is only possible to perform spot checks. This is not a problem when, for example, the average degree of ripeness of a banana bunch needs to be determined. However, the rotten fruit in a box of oranges can only be discovered in this way by chance. It is, therefore, important to find a fast, reliable, and non-invasive method that can be used, for example, to automatically sort out defective fruit in a sorting plant.

Measuring the Backscatter

ATB researchers test the methodology of so-called optical imaging backscatter measurements: the experimental setup consists of five dot laser modules with wavelengths of 532nm (green), 660nm (red), 785nm, 830nm, and 1060nm (near infrared). The fruit is irradiated, alternating between one or more of these lasers. The light is reflected in two different ways. The first reflection is the classic Fresnel reflection, in which the photons are reflected at the surface of the sample. The second reflection, the so-called diffuse reflection, is much more interesting to scientists. This reflection provides information about the proportion of light that penetrates the sample. In the sample, the light interacts with the inner parts of the fruit before it is scattered back to the tissue's outer surface. In addition to the absorption properties, other important information about the morphology and tissue structure of the fruit can be determined. To achieve accurate results, the light must penetrate as deeply as possible into the fruit. Therefore, scientists require particularly powerful laser modules. A monochrome CCD camera is used for evaluation, which provides researchers with detailed information on the propagation of the light inside the fruit. From this information they can draw conclusions about a possible fungal infection.

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1 https://en.wikipedia.org/wiki/Penicillium_digitatum

Best Results with Visible Light

In the case of *Penicillium digitatum*, cell fluid accumulates outside the cells in the so-called apoplast. This changes the reflection behaviour compared to healthy fruit. With optical measurement technology, a fungal infestation can also be detected in oranges that appear completely undamaged to the naked eye. Scientists at ATB and the *Instituto Valenciano de Investigaciones Agrarias* were able to prove this in their experiment at all wavelengths tested. They achieved an average success rate of around 80% even at 532nm. This "hit ratio" increased with the number of different wavelengths that were added simultaneously. Using all five wavelengths at the same time, the average success rate was 96%; IR lasers made only a small contribution to the increase in efficiency. Scientists attribute this to the fact that visible light has a better signal-to-noise ratio due to its slightly higher scattering coefficient. In addition, NIR radiation is particularly strongly absorbed by water and carbohydrates. However, the concentration of these substances can also fluctuate strongly regardless of an infection.

Backscatter measurements make infestation visible early.

New Solutions Are Needed Urgently

The findings of the study could have a dramatic effect on the cultivation of oranges in the future. To date, the skins of citrus fruits have been treated after picking with a wax that contains fungicides and other chemicals. However, new findings and a change in public perception mean that citrus growers are now urgently looking for more environmentally friendly methods that keep the harvesting yield as high as possible.

Environmentally friendly procedures are urgently needed.

The optical method would certainly be a cost-effective alternative for sorting out infested fruit early on. However, several years will probably pass before research becomes a technology suitable for mass production. ■

Dr. Manuela Zude-Sasse studied chemistry and held postdoctoral positions in the USA and France. Since 2007 she has been working as a research group leader for Precision Horticulture at the Leibniz Institute of Agricultural Engineering and Bioeconomy e.V., Potsdam (ATB).

After physico-chemical oriented studies at the University of Applied Sciences, **Christian Regen** has been working as a test engineer at ATB for more than 10 years and is responsible for the construction and programming of test benches.

https://twitter.com/Prec_Hort

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A High-Tech Way to Protect the Environment

Need-based Fertilisation through "Smart Farming"

Plants cannot grow without nitrogen, it is an important component in the formation of amino acids and nucleic acids. It is also needed to form the pigment chlorophyll, which plays a crucial role in plant metabolism. Plants absorb nitrate (NO_3^-) found in the soil as their source of nitrogen. Later it is returned to the soil via rotting organic matter. Nitrate that remains in the soil is decomposed there by anaerobic bacteria and re-enters the atmosphere as nitrous oxide (N_2O) and gaseous nitrogen; or it is flushed out and ends up in groundwater. Nitrous oxide is considered a dangerous greenhouse gas, and high nitrate concentrations in water pose a health risk because it is converted into carcinogenic nitrite in the body.

Si Avalanche Photodiodes

With a sensitive range of from 260nm to 1100nm, silicon photodiodes cover the entire visible spectrum into the near infrared range. They are therefore particularly suitable for use in the visible spectrum. They are inexpensive, easy to manufacture, and are considered to be particularly low noise. For applications where even small amounts of light have to be detected, we recommend Si avalanche photodiodes. With appropriate band-pass filters, specific wavelengths can be used selectively.

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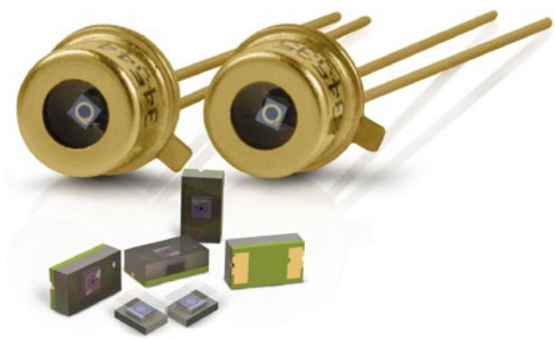
WEB UK66-0350



The Nitrogen Dilemma

Farmers are faced with a dilemma in plant cultivation: on the one hand, they want to promote plant growth and must ensure that the soil contains enough vital nitrate. On the other hand, they want to work in an as environmentally friendly way as possible and avoid harming the atmosphere and groundwater. They can only achieve both if they always know exactly how much nitrogen the grain currently requires. Nitrate concentration in soil is rarely uniform. The yield is correspondingly irregular. In conventional agriculture, an average amount of fertiliser is usually ascertained, and spread across the entire field.

The Right Green

So-called "sub-area-specific inventory management" aims to solve this dilemma. This involves determining the condition of the soil and the plants in as small a scale as possible and dynamically adjusting the quantity of fertiliser to meet current requirements. Determining the amount of fertiliser while the grain is in the fields is a challenge. Fritzmeier Umwelttechnik GmbH & Co. KG has developed a light-based solution for this. The chlorophyll of plants plays an important role in this process since it is responsible for photosynthesis and is thus crucial in the metabolic cycle of plants. The amount of chlorophyll in the leaves is a good indication of the nitrogen requirement because the plant uses this to develop the pigment. Nitrogen deficiency is therefore indicated by the fact that too little chlorophyll is available. Older leaves appear light green or yellow and often have brownish tips. If there is an oversupply of nitrogen, the result is soft, unstable, blue-green coloured leaves. These differences in leaf colour are not always visible to the naked eye. However, a sensitive sensor can detect the differences in radiance from which the nitrogen supply of the plant can be deduced.

More Yield – Less Environmental Damage

Fritzmeier uses this measuring method for its ISARIA PRO Active and ISARIA PRO Compact systems. The sensors are mounted directly on the tractor with which the farmer spreads the fertiliser. With the aid of software, the fertiliser can be controlled based on the amount needed, and each plant receives as much nitrogen as it requires at any given moment. The manufacturer was able to prove in tests that the economic efficiency, for example in grain cultivation, can be increased by more than 10%. The bottom line is that farmers and the environment benefit equally from smart farming. ■

NEW PRODUCTS

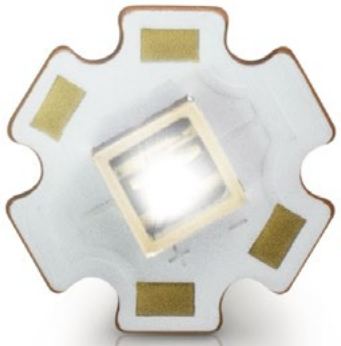
Global Novelty: Switchable Light Source

Visible and Invisible Wavelength from the Same Chip

WEB UK66-1740

LaserLight SMD W-IR is the world's first white light source that can be transformed into an IR emitter on demand. As usual from the manufacturer SLD Laser, the white light source offers a high range, narrow beam angle, and outstanding properties in luminous flux (450 lumens) and luminance (1000Mcd/m²). In IR operation, an output of 250mW is achieved at a wavelength of 905nm or 850nm. Both emitters are housed on the same 7mm x 7mm chip. To facilitate PCB assembly, the chips are also optionally available on starboard.

IR wavelengths are mainly used in professional security applications. With the new chip, it would be conceivable in the future, for example, for the surveillance camera to automatically switch on the light as soon as suspicious movements were detected.



The motion sensor and lighting could be accommodated in the same device in a space-saving manner and without complex cabling. ■

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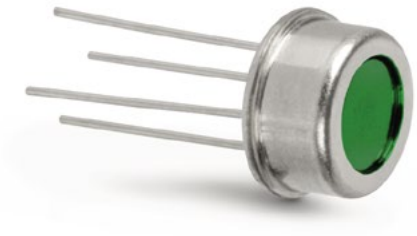
High Detectivity at Low Modulation Frequencies

Temperature-stable Pyroelectric Detectors

WEB UK66-0330

Fourier-transformed IR spectroscopy (FTIR) requires particularly sensitive detectors. At low to medium modulation frequencies, special pyroelectric LTO detectors are very well suited for this purpose. LASER COMPONENTS' LT3111 series pyroelectric detectors offer high detectivity and a good signal-to-noise ratio at low modulation frequencies. At 10Hz the specific detectivity is typically 4.0 E+09 Jones. As a result, the LT3111 detectors perform similarly to the more expensive thermoelectrically cooled semiconductor detectors.

For pyroelectric detectors, the basic rule is that thinner chips provide higher detectivity. In this case, we use chips with a thickness of 7µm. LTO chips are extremely robust and above all temperature stable. While other detector types in industrial environments require a Peltier element, LTO technology works



well even at high temperatures without additional cooling. ■

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FLEXPOINT® Modules with Pulsed Continuous Wave Lasers

Laser Protection Class 2 at High Energy Output

WEB UK66-2740

In industrial image processing "more light" means faster shutter times and shorter process times. More images can be captured and evaluated per second. At the same time, however, most systems must also meet laser class 2 requirements to protect employees' health. FLEXPOINT® MVpulse line laser modules have combined both requirements for the first time. The continuous wave laser beam is pulsed by an integrated micro-controller in such a way that each pulse is up to five times stronger than would be possible in cw operation. Measured along a defined pulse sequence, the module still meets the requirements of laser class 1 or 2, respectively.

An electronic system developed by LASER COMPONENTS monitors the control signals of the application, allowing the light to always be available when it is needed for the application. At the same time, the energy and duration of the individual pulses can be adjusted in such a way that the laser protection requirements can always be met.

The FLEXPOINT® MVpulse is available for the wavelengths 640nm, 660nm, and 780nm and delivers output powers of 10mW to 100mW at pulse lengths between 15ms and 0.38ms. ■

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iC-Haus Laser Diode Drivers

Extensive Range Available

WEB UK66-0550

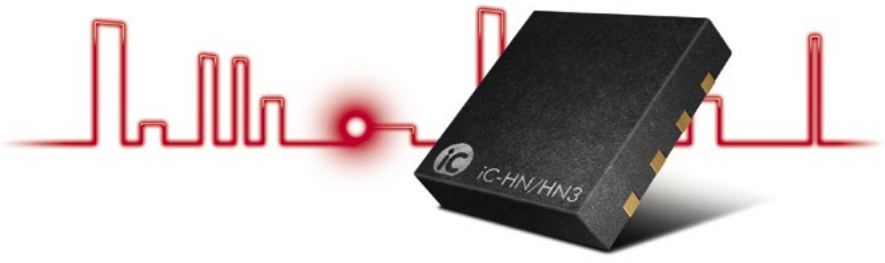
LASER COMPONENTS has established long term supply partnerships with several of the world's leading laser diode and laser diode driver suppliers. We work closely with our partners to offer a comprehensive range of laser diodes and can assist in the design-in of appropriate laser drivers alongside our laser diode products.

iC-Haus laser diode drivers provide fast switching, avoid overshooting by patented circuits, and feature various monitoring safety functions. They offer an extensive range of laser diode driver iCs for all types of CW and pulsed semiconductor laser diodes.

Examples include:

- open loop drivers, which provide spike-free switching and simple current setting via CMOS or TTL/LVDS inputs
- single and dual CW drivers with automatic power control (APC) via the laser monitor photodiode, or automatic current control (ACC)
- modulation drivers with averaging or peak output power control

Fully populated evaluation boards are also available for most drivers to help new customers accelerate their R&D phase. ■



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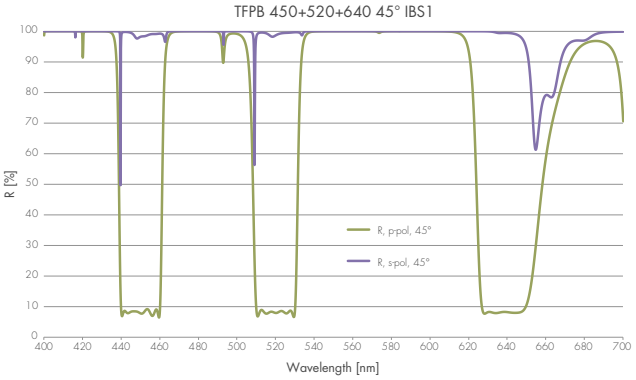
Polarise Three Wavelengths Simultaneously

Trichroid Thin-Film Polarisers



WEB UK66-1010

LASER COMPONENTS has for the first time developed a thin-film polariser that makes it possible to simultaneously separate the polarisations of three wavelengths. Designed for an angle of incidence of 45°, the optics show excellent reflection properties for s-polarisation in blue (450nm), green (520nm), and red (640nm) light, while p-polarisation is almost completely transmitted.

In optical systems, such polarisers can be used, among other things, to combine linearly polarised laser beams from several sources – regardless of whether they have the same or different wavelengths.

Conversely, these types of optics make it possible to separate unpolarised light at three wavelengths into the two polarisations simultaneously.

While the manufacture of thin-film polarisers is no longer an art, trichroid polarisers present a major challenge. The complex layer design is produced in our ion beam sputtering (IBS) facility, which enables particularly compact layer structures with good reflection properties. ■

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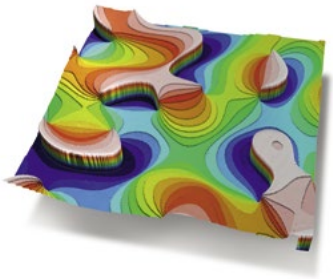
Polymer Structures on Quartz Glass

Cost-effective Diffractive Optics for Medium Output Power



WEB UK66-0031

With new technology, Holo/OR has expanded the manufacturing options for diffractive optical elements (DOEs), thereby significantly reducing the cost of mass production of low and medium power optics in medium and large quantities.

In the new polymer-on-glass (POG) optics, the polymer layer that has DOE structures is applied to one side of a stable quartz glass substrate. The other side can be equipped with an anti-reflective coating for the wavelength used. POG optics offer a laser damage threshold of more than 10J/cm^2 for laser pulses of 8ns at 1064nm. With a high transparency in the wavelength range between 450nm and 1080nm, they are suited for many types of lasers in the visible and infrared range.

POG DOEs are used as beam shapers and splitters in applications such as 3D sensor technology, medical technology, and industrial image processing. ■

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Light, Compact, Ultra-stable Retroreflectors

Space-capable Design

WEB UK66-2020

With their light, compact design, ultra low-profile retroreflectors (ULPRs) are used where other retroreflectors do not have any room. The manufacturer PLX has succeeded in reducing the weight by another 36% compared to standard reflectors. Thanks to their round design, they are ideal for installation in drill holes, optical mounts, and mirror mounts.

With their elegant design, retro-reflectors are still extremely resistant to temperature fluctuations, vibrations, and shocks.

ULPRs are available in standard sizes from 12.7mm to 125mm. For the most important applications such as distance measurement, FTIR interferometry, and spectroscopy, a wide range of metal coatings is available for wavelengths from UV (225nm) to IR (20µm). Upon request, customers can also have their own specifications implemented. ■

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1×2 High-Directivity Fibre Optic Multimode Couplers

Achromaticity and Mode Insensitivity over 400–1625nm

WEB UK66-0115

LASER COMPONENTS offers SEDI-ATI's special multimode coupler series for optical metrology and sensing, where the dynamic range of the sensor is a key parameter. The unique manufacturing technology of these couplers is based on wavefront division. The main benefits of this technique, other than high directivity, are mode insensitivity and achromaticity.

The optical signal is input through the injection port of the 1×2 coupler (the light source) onto a measured surface. The light can be backscattered by an object to be analysed, either as it is, or with a shifted wavelength. The reflected light is gathered back through the common fibre (port 3) followed by redirection towards the second port of the coupler to the detector.

High directivity is a great advantage to minimise the light that can directly pass from the injection port to the output port. Also, the insertion loss from port 1 to port 2 is < 6.5dB with a total reflection at the common port. This way, a minimal mismatch between the input and the reflected signal is achieved.

Key features:

- High Directivity > 55dB (with GI 50/125µm)
- Achromaticity and mode insensitivity over the wavelength range 400–1625nm
- Low insertion loss in round trip configuration ≤ 6.5dB (can be lower than 6dB if not used at fully filled stage) ■

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Low Residual Amplitude Modulator Phase Modulator

NIR-MPX Series from iXblue

WEB UK66-0960

LASER COMPONENTS would like to introduce our range of phase modulators especially designed to operate in the 1000nm wavelength band.

The NIR-MPX series uses a proton exchanged based waveguide process that gives them an unparalleled stability even when operating at high optical power. The NIR-MPX phase modulators come with high PER and low IL options. They feature a high input optical power (25dBm) along with a low Vpi, typically 1.5V.

The NIR-MPX-LN-0.1 phase modulator has become the reference component for many applications involving lasers such as spectrum broadening for suppression of the stimulated Brillouin back scattering effect (SBS), Pound-Drever-Hall (PDH) and coherent laser beam combining (CBC) techniques. One of the key parameters determining the performance of the modulation is the residual amplitude modulation (RAM).

The NIR-MPX-LN-0.1 phase modulator combined with its matching RF driver DR-VE-0.1-MO can be specified with an exceptional 30dB of RAM. ■

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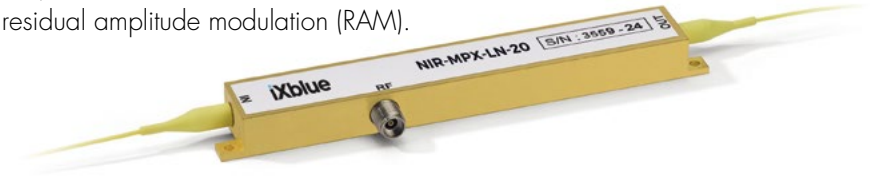

Optical Wavelength Splitter OWS200

Eliminate the Need for Expensive DWDM Power Meters

WEB UK66-0220

TEMPO's optical wavelength splitters allow a standard powermeter (OPM) to be able to measure signal levels in WDM networks. The wavelength splitter OWS200 "splits" multiplexed wavelengths found in NGPON2 networks (Next Generation Passive Optical Networks) also known as TWDM-PON, allowing specific wavelengths to be measured with a conventional optical powermeter. Configurable for 2,4 and 8 wavelengths and has low return loss to protect network disruption. ■

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LIGHT SOLUTION

for your Application Needs

FIBRE AMPLIFIERS

- Erbium/C and L band
- Erbium broadband ASE source
- Ytterbium and thulium
- CW in range 0.5xxµm to 2µm
- Pulsed 1µm and 1.5µm

APPLICATIONS

- Remote sensing (LiDAR)
- Digital/video/free space communications
- Optical metrology
- Environmental monitoring
- Telemetry-mapping
- Non-linear optics

FIBRE LASERS

- Erbium, ytterbium, Raman and thulium
- CW in range 0.5xxµm to 2µm
- Pulsed in range 0.355µm to 2µm
- Low RIN and low phase noise
- Compact OEM modules

KEOPSYS BY LUMIBIRD

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