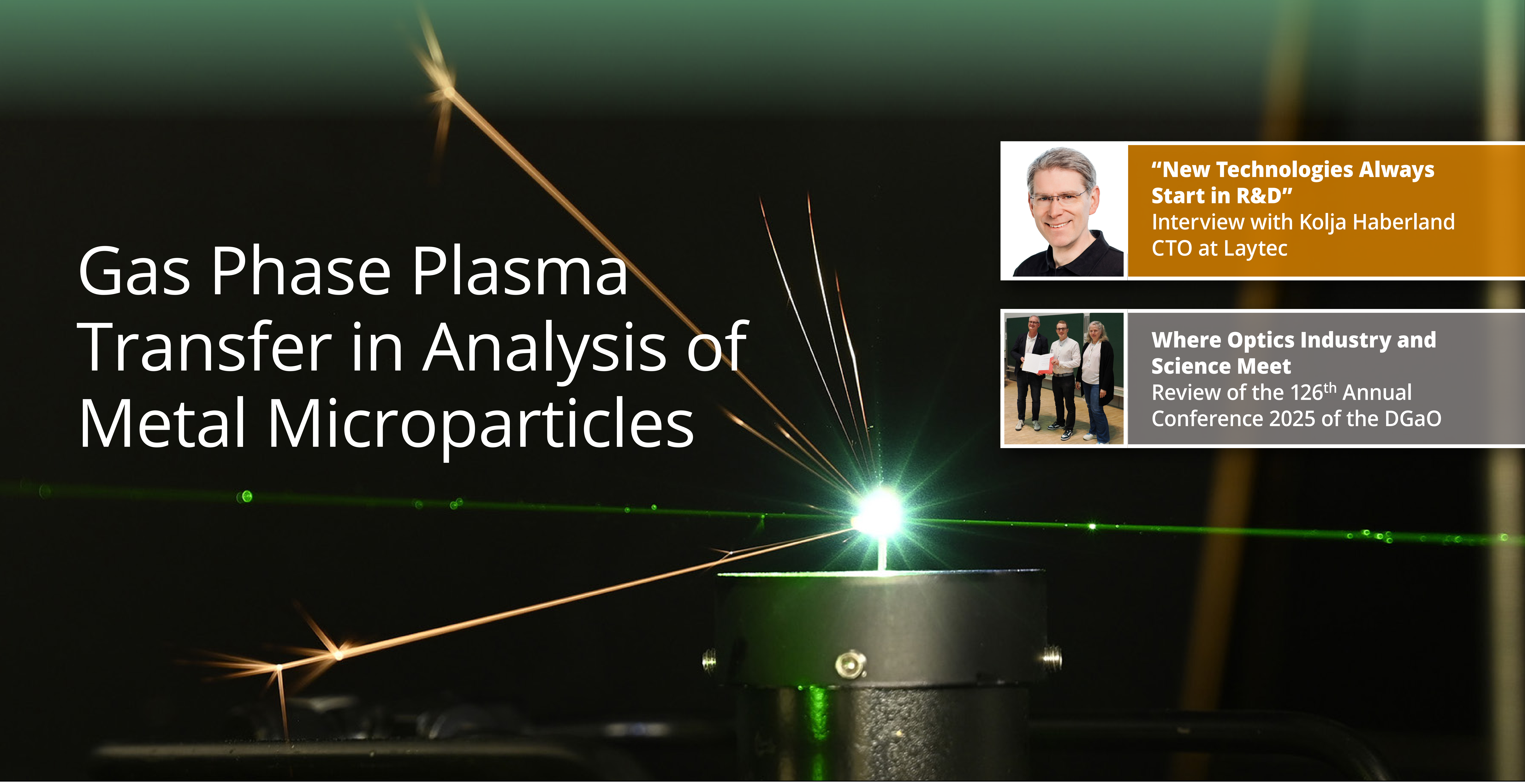
PhotonicsViews

OPTICS • PHOTONICS • LASER TECHNOLOGY

March 2026
www.WileyIndustryNews.com



Gas Phase Plasma Transfer in Analysis of Metal Microparticles

"New Technologies Always Start in R&D"
Interview with Kolja Haberland CTO at Laytec

Where Optics Industry and Science Meet
Review of the 126th Annual Conference 2025 of the DGaO

emva european machine vision association · ICC spectronet global collaboration in photonics · VDMA Machine Vision · edge ai + vision ALLIANCE · VISION · Control · AUTOMATICA · EPIC European Photonics Industry Consortium

WILEY

Needs the European Photonics Industry to Become More Independent?

The photonics industry grows while other industries are facing serious problems, such as the automotive industry. Spectaris and SPIE unanimously report that forecasts continue to predict annual growth of between 6 and 7 percent. The only problem from a European perspective is that Asian companies are taking over more and more market share. The reasons for this are complex. And in some cases, this development may even be intentional, or at least accepted. This is because Asia, especially China, is one of the largest component providers and at the same time buyers of European photonics products.

The question is therefore: Is the photonics industry developing in a similar way to the automotive industry, which initially did brisk business in China but ultimately ensured that the chinese automotive industry was able to take off? The result is that China is building better and cheaper (electric) cars for its domestic market and the country is increasingly shielding itself from foreign competition. What can be done?

The obvious answers are: European research funding, strengthening the location through fewer legal requirements and cheaper labor, perhaps even direct subsidies. All of this is debatable. The point, however, is that all this is of little use when faced with an opponent who has no interest in fair economic competition, but instead massively subsidizes its own companies and deliberately builds up overcapacity in order to flood foreign markets with absurdly cheap products.

In my view, one must decide how much of the today's business one is willing to sacrifice in order to survive in the long term. Or, to put it another way: How smart and powerful do one wish to make the Chinese competition, the Chinese state, before pulling the ripcord? The automotive industry has shown that it is very, very painful if the point of no return is missed.

Enjoy reading!

David Löh
Editor-in-Chief of PhotonicsViews
dloeh@wiley.com

Contents

4 News

6 Where Optics Industry and Science Meet
Review of the 126th Annual Conference 2025 of the DGaO in Stuttgart

8 "New Technologies Always Start in R&D"
Interview with Kolja Haberland CTO at Laytec

11 Gas Phase Plasma Transfer in Analysis of Metal Microparticles
Ultrashort Pulse Laser in Spectroscopy Applications

15 A Usable Workflow in Optical Metrology
Handheld Scanner Improves Certainty in Everyday Quality Control

17 Weld Seam Inspection Through Optical Coherence Tomography
Efficient Quality Assurance in Gas Metal Arc Welding

19 Fresnel Lenses as an Economic Alternative to Aspheric Lenses
Optical Components in Large Quantities for Illumination Systems

22 Active Alignment in Assembly and Connection Technology
Manufacturing Highly Integrated Photonics and Optoelectronics Systems

23 Products

29 Index / Imprint

New Board Confirmed in the Spectaris Photonics Association

The Spectaris Photonics Association has elected a new Board of Directors. Maik Müller, CEO of Nynomic, was confirmed as Chairman of the Board. New to the board are Andrzej Grzesiak from Schott and Oliver Haupt from Coherent Laser Systems, who broaden the industrial perspective of the board.

Maik Müller emphasized the importance of strong representation of the photonics industry's interests in the face of growing geopolitical and technological challenges. The board elections took place as part of the Spectaris Photonics Industry Day, which was held at Coherent Laser Systems in Göttingen, Germany, and promoted the exchange of views on current industrial applications.

Image: Spectaris

The new Photonics Executive Board

Management Change at Fisba

Fisba has announced a planned change in management. Christian Zellweger will assume the role of CEO, while long-time CEO Markus Hersche will move to the Board of Directors. This move is part of a strategic succession plan designed to ensure continuity in management and strategy.

Zellweger, who has been COO at Fisba for five years, will drive forward initiatives to strengthen the company and secure growth. Under Markus Hersch's leadership, Fisba has driven forward its internationalization and consolidated locations in Shanghai and Saco. All operational processes and quality standards will remain unchanged for customers, partners and employees.

Image: Fisba

New Advice for Photonics Innovations

Scott Jordan, an industry expert, has announced the formation of Aikidovation. This is a technology consulting firm focused on growth, innovation and organizational transformation in silicon photonics, semiconductor manufacturing and related high-tech industries. With over 30 years of experience in high-tech commercialization, including leadership positions at Physik Instrumente, Jordan brings extensive knowledge to the consultancy. Aikidovation offers a flexible group of experts providing services in the areas of opportunity analysis, R&D acceleration, market development and structural or cultural realignment.

Image: Physik Instrumente

A special offering is "Skunkworks-as-a-Service", which enables clients to pursue confidential innovation projects. The consultancy uses advanced tools such as artificial intelligence to accelerate insights and maintain confidentiality.

Hoerbiger Takes over Physik Instrumente

Physik Instrumente (PI) is acquired by Hoerbiger. PI, founded in Karlsruhe in 1970, is known for piezoelectric drives and multi-axis systems used in semiconductor manufacturing, photonics and medical technology. With 1,900 employees, PI will form the new Positioning Division at Hoerbiger as an independent unit.

The acquisition, which is still subject to regulatory approval, is expected to be completed in the first quarter of 2026. Markus Spanner, CEO of PI, sees the partnership as a logical development step, while Dr. Thorsten Kahlert, CEO of Hoerbiger, emphasizes the synergy and shared values of the companies.

Image: Physik Instrumente

At the signing of the contract. From left to right: Thorsten Kahlert, CEO Hoerbiger, Markus Spanner, CEO PI, Karl Spanner, founder PI and Martin Komischke, Chairman of the Board of Directors Hoerbiger.

Where Optics Industry and Science Meet

Review of the 126th Annual Conference 2025 of the DGaO in Stuttgart

In June last year, the 126th Annual Conference of the German Society for Applied Optics (DGaO) was held once again successfully. For four days, scientists from academia and industry exchanged ideas on current topics in optical metrology, optics simulation and design, and new manufacturing technologies. Conference manager Prof. Dr. Stephan Reichelt from the Institute of Applied Optics (ITO) at the University of Stuttgart looks back on a positive event with high-caliber contributions.

For the first time in the more than 100-year history of the DGaO, the annual conference was held at the University of Stuttgart. The extensive program comprised 20 sessions with 80 short presentations on current topics in applied optics, seven keynote lectures and 37 poster contributions.

The core topics of the conference were reflected in the keynote speeches. In the opening lecture, Prof. Reichelt presented research results relating to single-shot measurement methods for the analysis of dynamic processes. The Optical Design session opened with the keynote lecture by Prof. Dr. Herbert Gross on the simulation and tolerancing of optical systems with freeform surfaces, which highlighted the particular challenges in the development and quality assurance of freeform optics. Prof. Dr. Colin Sheppard (UNSW Sydney) reported on image scanning microscopy and presented innovative approaches to improving resolution in confocal microscopy through the use of detector arrays. Simon Hartel (Landshut University of Applied Sciences) gave a fascinating insight into the possibilities of geometric algebra for system optimization, exemplified by light sectioning systems.

Participants of the DGaO annual meeting 2025 in Stuttgart

Interferometry

The interferometry sessions were introduced by a lecture by Florian Dötzer (TU Ilmenau), who discussed the role of object and detector in the design of camera-based interferometric systems for vibration measurements in the picometer range. Topics relating to innovative manufacturing processes for optical components and systems were discussed in several sessions. In his keynote speech, Dr. Stefan Risse from the Fraunhofer Institute for Applied Optics and Precision Engineering (IOF) presented an overview of the current status of the production and characterization of metal optics with freeform surfaces. He showed the impressive progress made in deterministic processing and demonstrated how nanometer precision can

DGaO Young Scientist Award 2025 for Dr. Simon Amann

be achieved in large optical components. Finally, Dr. Vladimir Mitev (Carl Zeiss SMT) reported in his presentation on the extreme demands on optics production for EUV lithography. He explained how Zeiss mirrors with precision requirements in the picometer range form the basis for the production of state-of-the-art microchips and thus enable the continuation of Moore's Law.

The Fraunhofer lecture given by Dr. Peter de Groot (Zygo, USA and 2025 President of the SPIE) was another highlight. The renowned researcher with over 140 US patents reflected on creativity and innovation in optics in an entertaining lecture as part of the conference banquet.

Award and Panel Discussion

The program was complemented by a panel discussion, moderated by Dr. Ulrike Böhm (Carl Zeiss), on career prospects in optics and photonics, which was particularly well attended by young scientists. In particular, the challenges of starting a career, career paths and the importance of professional networks for success in optics and photonics were discussed.

This year, the DGaO once again honored outstanding scientific work by young researchers with the DGaO Young Scientist Award. Andreas Brenner received the award for his master's thesis "Calibration of light modulators with physically interpretable neural networks", while the prize for the best doctoral thesis went to Dr. Simon Amann for his dissertation "Novel concepts for the realization of a miniaturized computed tomography imaging spectrometer". The certificates were presented by DGaO President Ricarda Kafka and Prof. Dr. Steffen Reichel, head of the prize committee.

New president of DGaO elected

The DGaO general meeting took place during the conference, at which Prof. Dr. Steffen Reichel (Pforzheim University of Applied Sciences) was elected as the new president of the DGaO. The baton for the organization of the next annual conference was officially handed over to Prof. Dr. Oliver Baumann from HAW Hamburg, who is looking forward to a successful conference in 2026 as the new conference director.

The success of the conference in Stuttgart is primarily attributed to the high level of commitment of all participants. In particular, the conference management and the entire ITO team on site as well as the outstanding work of the program committee under Prof. Dr. Christian Faber contributed significantly to this achievement. 220 participants from Germany and abroad confirm the event's excellence. We would also like to thank the sponsors for their support. The accompanying industry exhibition rounded off the program and offered excellent opportunities for dialogue between science and industry.

This year's event

127th Annual Conference 2026 of the DGaO in Hamburg

In addition to keynote speeches on topics such as optical design, biomedical applications, additive manufacturing, and material processing, parallel sessions will focus on current research advances: from optical metrology to interferometry and vibration measurement to optical materials and modern design methods.

The event also offers ample opportunity for networking, whether during coffee breaks or poster sessions. A panel discussion will also facilitate professional exchange on current developments and challenges in the optics industry.

The last day of the conference begins with a festive symposium in honor of the 100th birthday of Prof. Adolf Lohmann. The physicist pioneered in optical information processing and -computing and was one of the fathers of computer-generated holograms.

Find the full program on the event's page.

AUTHOR
Dr. Christof Pruß
Institute of Applied Optics (ITO) at University of Stuttgart

CONTACTS
Deutsche Gesellschaft für Angewandte Optik, Pforzheim, Germany

“New Technologies Always Start in R&D”

Interview with Kolja Haberland CTO at Laytec

Kolja Haberland, CTO at Laytec, talks about the early years of the company and explains how they managed to grow from a three-person operation to a globally active medium-sized enterprise. Today Laytec is a global provider of advanced process-integrated metrology-systems, used in semiconductor, laser, LED, PV and thin-film manufacturing.

Already in the 90s, you were working on in-situ metrology of III-V materials. How did this lead to the creation of Laytec?

Kolja Haberland: Laytec started in 1998 while I was doing a PhD in Physics at the Technical University of Berlin. I was working on metrology for III-V materials using an optical tool called a reflectance anisotropy spectrometer (RAS), a non-invasive optical instrument we had developed in Berlin that characterizes the optical anisotropy of a surface.

> *“New technologies always start in R&D, so if you only focus on industry customers, you might lose the connection to the next innovation.”*

This tool was really useful to understand what is going on inside an MOCVD system during growth of III-V materials like Gallium Arsenide and Indium Phosphide. We published data, went to conferences and attracted a lot of interest because at that time, there were no standard tools for in-siu metrology of III-V epitaxy. Researchers started to ask us to build them an RAS system, so two colleagues and me co-founded Laytec in 1999, and when the company grew, I took the role of CTO.

How has Laytec developed?

Haberland: Initially, we focused on in-situ metrology for thin-film growth epitaxy processes like MOCVD, especially for LEDs and lasers. By the late-2000s we had grown rapidly and we broadened into in-line metrology for large-area deposition techniques for amorphous, polycrystalline, organic thin films as used in photovoltaics (PV) and display industries. Today we are also providing stand-alone wafer mapping systems and in-situ metrology for dry etching processes.

In 2018 we had reached a size and market penetration where we wanted to talk to large semiconductor players in Asia and the US. However, we did not have the capacity to achieve this. With the takeover by the Nynomic Group, we were able to benefit from their experience, expertise, and innovative strength.

We now have a workforce of 70, and an international distribution and service network covering Europe, China, Taiwan, Korea, Japan, Malaysia, North America, and India. Over the last almost 30 years we have installed more than 4,000 metrology systems worldwide.

Kolja Haberland, Co-founder and CTO of Laytec

Laytec provides process-integrated metrology-systems, used in semiconductor, laser, LED, PV and thin-film manufacturing. In picture: Epicurve TT system, which is used for measurements in the curvature range from -7000 km-1 (convex) to +800 km-1 (concave).

How did you get through the early days of your business?

Haberland: In the beginning, the competition was not very strong because we found a niche where nobody was offering anything useful. There were only very simple tools available, but they were not good or precise enough for industry and we were the only company able to offer a sophisticated in-situ metrology tool combining optical expertise with process knowledge. We had good links to Aixtron, a major MOCVD provider, that also helped to get a footprint in the market.

Large semiconductor equipment companies don't like integrating components from a small company into their product portfolio because there's a risk that the small company will go bust or get taken over, so there's no guarantee of support for the next 10 years in spare parts. By joining the Nynomic Group in 2018, which has more than 100 million revenue per year and workforce of 500, we're now recognized as a large player. That's helped us to open doors in the semiconductor industry and enter new markets served by the other companies in the Nynomic Group.

What were your main challenges at the beginning?

Haberland: Today, universities are very keen on having startups and helping them with incubator programs. But things were very different 25 years ago. Although the university was open to help us, there were no formal programs. So, we could rent a room of a couple of square meters in a laboratory, and we were allowed to use the infrastructure, including water, the photocopy machine and internet – that does not sound much, but it helped a lot!

From a technology perspective, we had to make quite a few changes to the product. Initially it was a complex research system that was difficult to align and tricky to interpret. The feedback from our industrial customers was that they needed something simpler. Accordingly, we developed a simpler system that just did reflectometry and temperature measurement with just three dedicated wavelengths instead of the whole spectrum. We then added wafer curvature measurements later.

What are your main products and who are your main customers?

Haberland: Our product portfolio covers all areas of thin film and semiconductor process monitoring and control, including in-situ metrology for deposition and etch, mapping, and in-line metrology. We bring everything together by, what we call, connected metrology.

Our industrial customers are manufacturers of semiconductor devices, solar cells and large-area thin-film coating and display manufacturers. We also target OEM equipment integrators and of course research institutions. In any case it is very important to us to stay in touch with our end users.

How difficult was it to convince device manufacturers to integrate your technology and bring it to end users?

Haberland: Equipment vendors tend to be wary about metrology because the tools needs to be integrated and qualified and of course it makes their machines more expensive. In contrast, the end user is more interested in value than in cost. Our metrology helps them get a better yield, solve problems and make things more efficient. Additionally, amortization of a Laytec tool in semiconductor industry is usually about six to eight months, which is a very good bargain.

MOCVD

MOCVD (Metal-Organic Chemical Vapour Deposition) is a process used to deposit layers no thicker than a single atom onto wafers. This kprocess is used, for example, in white LEDs.

To resolve this situation, we needed the end customer to tell the equipment vendor that they require our metrology and then the equipment vendor starts talking to us about integrating our metrology.

Do you think a new startup could be as successful using your strategy today?

Haberland: 25 years ago, MOCVD was like black magic. There was no established metrology so it was very easy to come up with a new idea. Today, the semiconductor industry is mature and highly automated with larger wafers, robots and qualified processes and very high requirements, so it's much more difficult for newcomers to get into the market.

While it may be easier today to start a company with more support from universities, it's probably more difficult to develop because you quickly end up with investors sitting on your board with their own agendas.

Then there are geopolitical problems. At the moment, the world economy is in a difficult state. Our market turned out to be a global market pretty quickly. Yes, we are selling to Aixtron, which is a German company, but it sells to all parts of the world, so most of our tools are in China and Taiwan. Now it's all international: Germany is expensive, China is cheap, the US wants to be independent and nobody knows what will happen to Taiwan. Founding a company under these circumstances is certainly challenging.

What's your advice for the next generation of company founders?

Haberland: For us, staying close to our R&D customers has been important because this is where we come from. New technologies always start in R&D, so if you only focus on industry customers, you might lose the connection to the next innovation.

Secondly, if you want to sell a product to a system integrator, get the system integrator into a sandwich position between you and the end user. The end users don't see your technology primarily as a cost factor, they see the added value. Even though you may not sell directly to the end customer, keep in touch with them because they are the ones one who use your product and it's important to get their feedback. In this way, you can find out where you can get better before a competitor does!

AUTHOR
Antonio Castelo
Technology Manager for Bio-Medical and Lasers at European Photonics Industry Consortium Epic

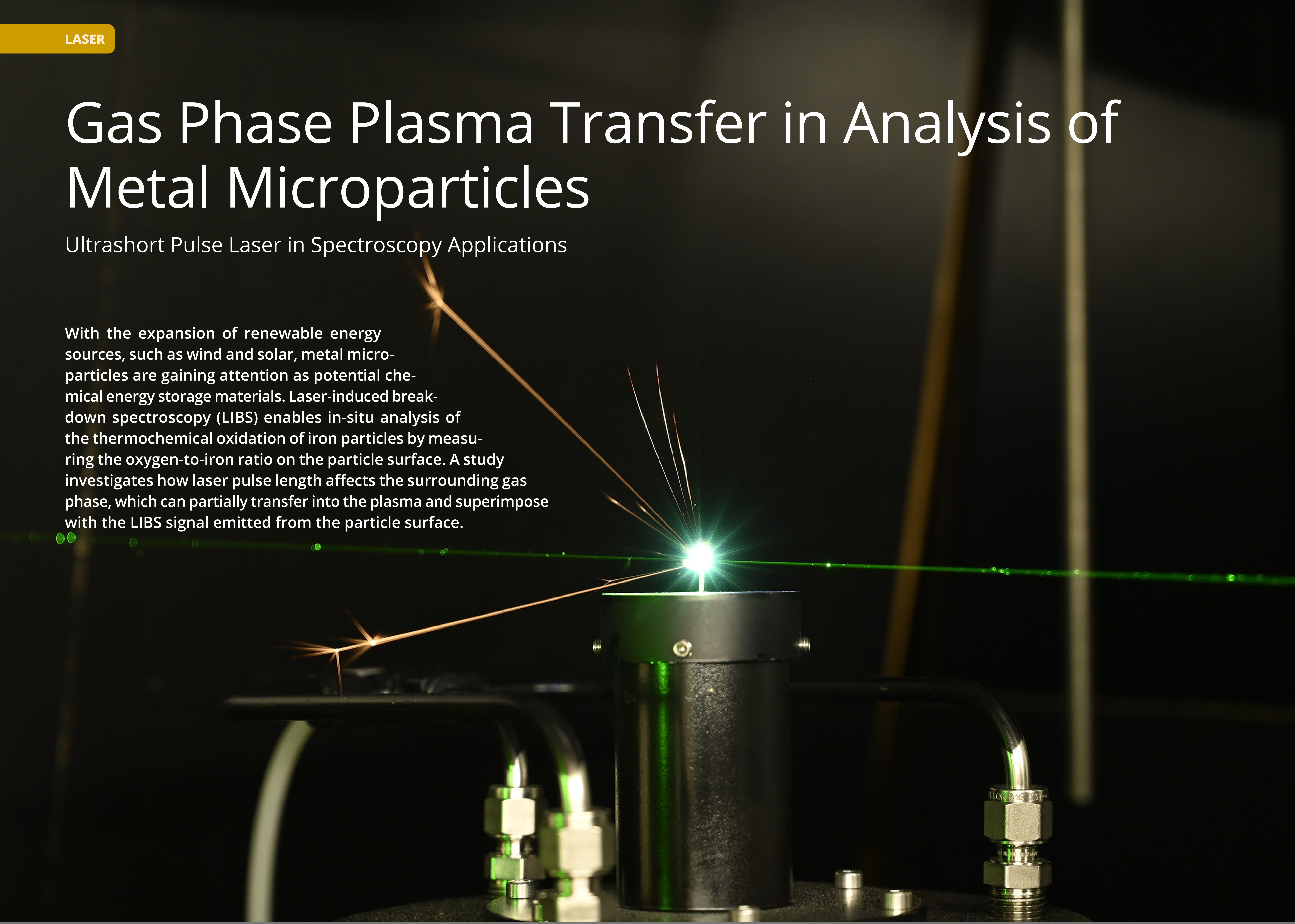
CONTACTS
Laytec AG, Berlin, Germany

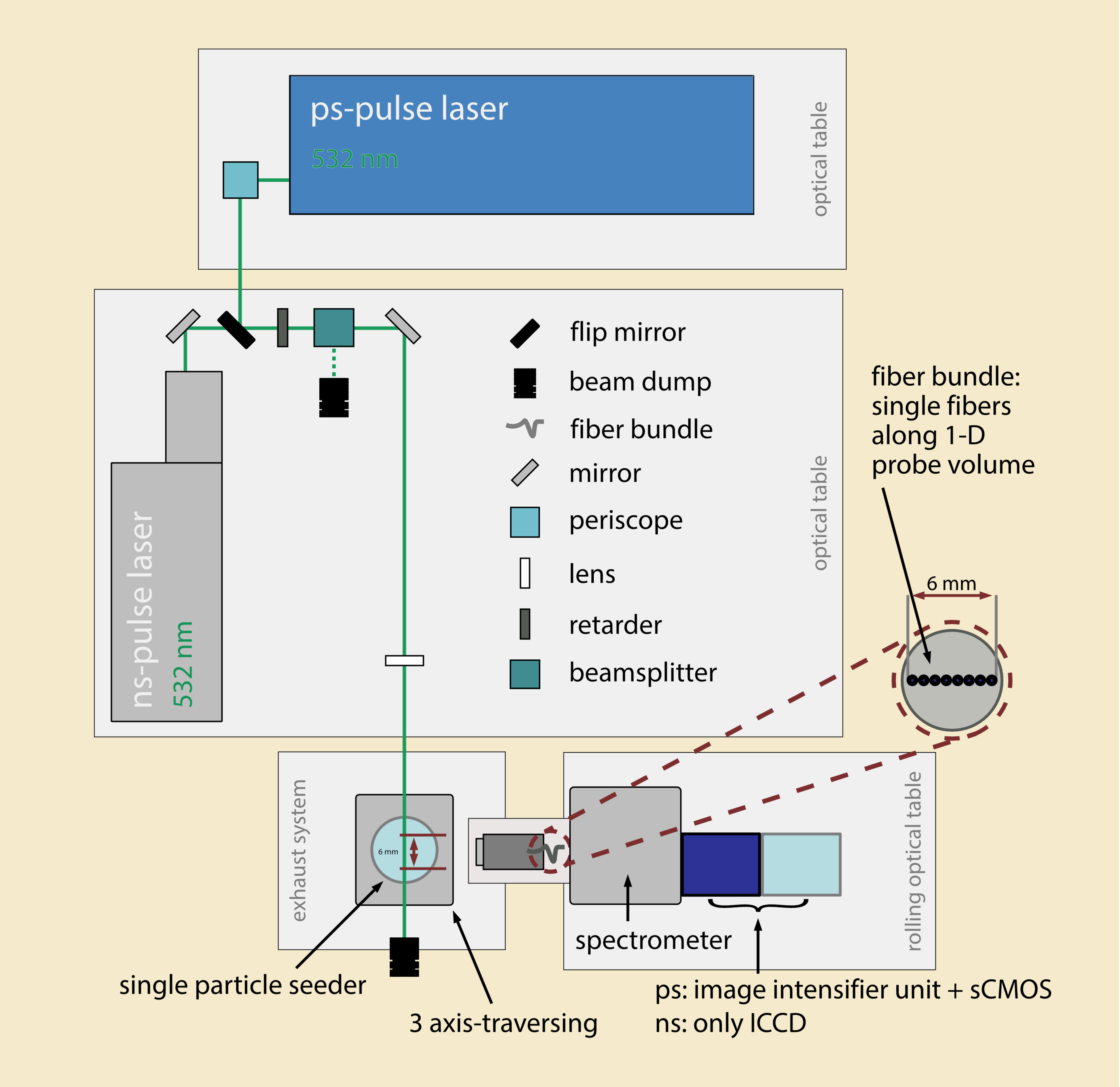
European Photonics Industry Consortium Epic, Paris, France

Gas Phase Plasma Transfer in Analysis of Metal Microparticles

Ultrashort Pulse Laser in Spectroscopy Applications

With the expansion of renewable energy sources, such as wind and solar, metal microparticles are gaining attention as potential chemical energy storage materials. Laser-induced breakdown spectroscopy (LIBS) enables in-situ analysis of the thermochemical oxidation of iron particles by measuring the oxygen-to-iron ratio on the particle surface. A study investigates how laser pulse length affects the surrounding gas phase, which can partially transfer into the plasma and superimpose with the LIBS signal emitted from the particle surface.





Experimental setup with excitation of the plasma by ns- or ps-pulse laser.

Metal microparticles have the advantage of high energy density and long potential storage times, making them well suited for storing renewable energy [1]. Iron oxide can be reduced by green hydrogen and later oxidized again to release energy in retrofitted coal fire power pants [2]. In-situ LIBS can analyze the atomic composition of surfaces during rapid, high-temperature oxidation, overcoming the limitations of ex-situ or low-time-resolution studies. This data is required for developing combustion-kinetics models. Diagnostics present challenges such as overlapping element spectra from the particle plasma and the surrounding gas that has inadvertently been transferred into the plasma. The data can be distorted by the LIB-spectra of the gas transferred into the plasma which depends on the laser pulse length (nanoseconds vs. picoseconds) and is analyzed in this study.

Laser-Induced Breakdown Spectroscopy – An Overview

LIBS uses high-intensity short laser pulses to convert small amounts of target material into plasma for optical analysis. Applicable to solids, liquids, and gases, it can detect elements without contact, enabling measurements without sample preparation and high time resolution.

A focused laser pulse excites a part of the sample, forming plasma when a minimum power density (optical breakdown threshold) is exceeded, typically ranging from a few up to a hundred GW/cm², depending on the sample. The absorbed energy ablates the surface of the particles, forming ions and electrons at temperatures of tens of thousands of Kelvin, initially generating a continuum emission that can interfere with later occurring element-specific emissions during the rapid cooling of the plasma.

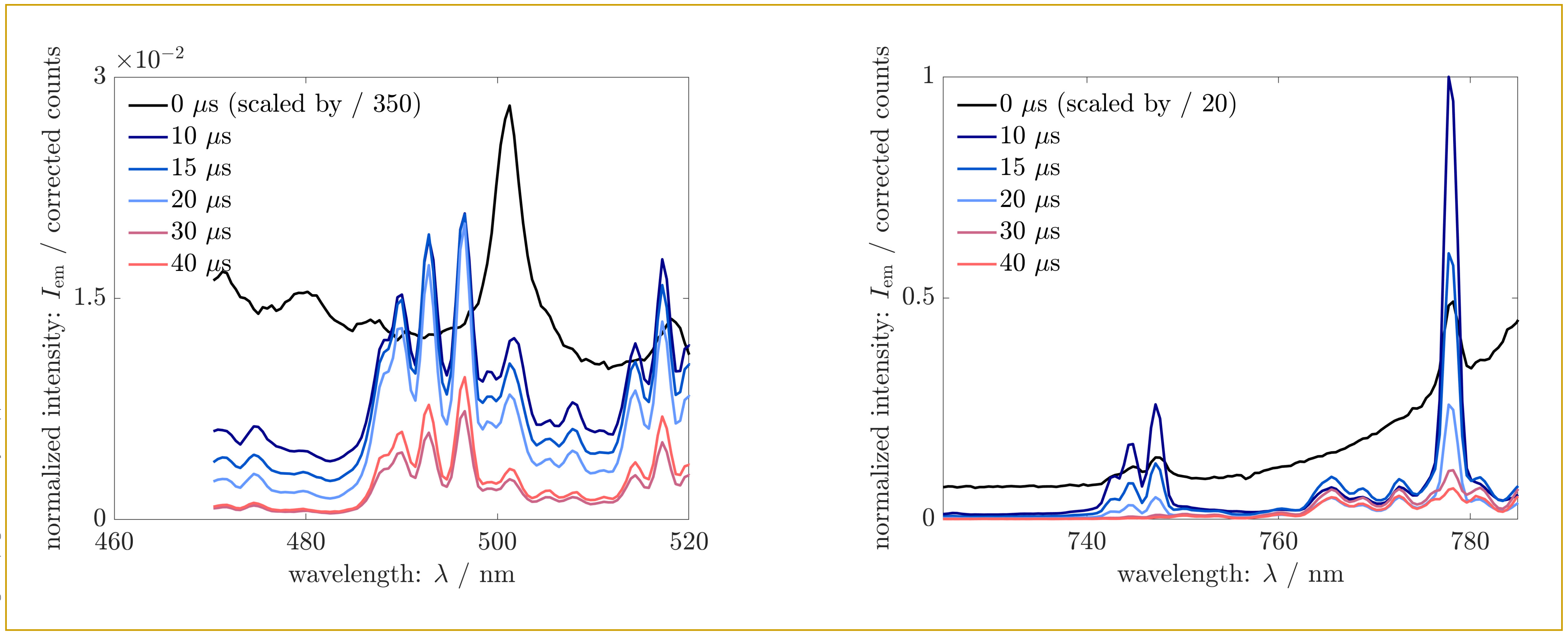


Image: Topag / University of Applied Sciences Darmstadt

Averaged plasma spectra excited by ns-pulse laser at different delay times. The Fe signal intensity is approximately 2 % of the O signal intensity.

Experimental Setup for the Analysis of Iron Particles

The test rig includes excitation, particle supply, and detection systems. Laser pulses with different length (532 nm, 6 ns/250 mJ or 30 ps/50 mJ) are focused into the probe volume via a 1,000 mm focal length lens. Fe particles (25 - 32 µm) are supplied as a jet through a single particle seeder with a coflow shielding from environmental interference. Electrostatic separation between electrodes and controlled volume flow ensures continuous delivery to the probe volume [3]. Plasma radiation is collected at 90° to the laser beam using lenses and guided to a spectrometer via a 54-fiber array bundle resulting in a 1D probe volume of 6 mm length.

For nanosecond-pulse excitation, an ICCD (100 ns gate) is used, recording Fe and O spectra separately due to weaker Fe emissions. For picosecond-pulse excitation, intensified relay system with sCMOS (5 ns gate) records the full spectrum simultaneously. Wavelength calibration uses neon (ns) or xenon (ps) lamps. Intensities are corrected by constant light source. Spectra are taken from center of plasma, defined by fiber with highest intensity in array.

Picosecond-pulses are provided by PL2251C from Ekspla, a mode-locked laser that provides short pulse duration of 30 ps with 10 Hz repetition rate and in addition high amplification, using two amplification stages, first diode pumped regenerative amplifier and second flashlamp pumped power amplifier. This enables pulse energy of 100 mJ at 1,064 nm (converted to 50 mJ at 532 nm) while keeping 30 ps pulse duration with a good beam profile and pulse stability. Laser electronics allow jitter of < 50 ps with pre-delay function for high reproducibility within the 5 ns acquisition window of the experiment.

Reduced Gas Phase Fraction with Ultrashort Pulses

In LIBS of microparticles, surrounding gas can transfer into the plasma. Time-resolved analysis shows that ns-pulse excitation generates long-lived plasma (tens of µs), while ps-pulse plasma decays within hundreds of ns. Fe emission originates from the particle, while N and O emissions (for pure Fe) originate from gas.

The O/Fe ratio reflects the particle composition; while interfering gas spectra result in an overestimation of the ratio. Ns-pulse excitation shows O signal ~ 50x stronger than Fe, while nanosecond-pulse yields comparable O and Fe signals. This demonstrates that picosecond-pulses lead to significantly reduced gas-phase contribution and improved measurement reliability. In both measurements results are normalized to the maximum value of the spectrum with the first delay time.

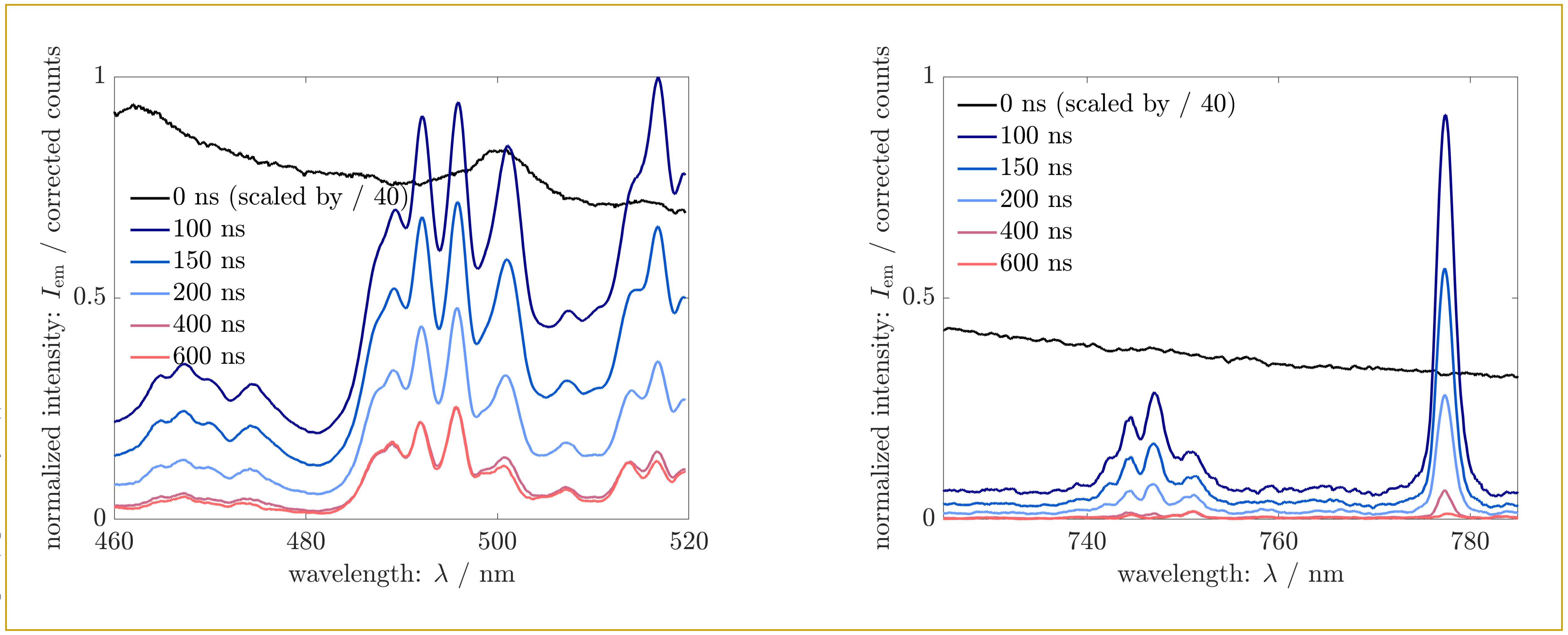


Image: Topag / University of Applied Sciences Darmstadt

Averaged plasma spectra excited by ps-pulse laser at different delay. The Fe signal intensity is in the same order of magnitude as the O signal intensity.

Emission lines of Fe atoms and ions in the first ionization state are observed within the 480 – 520 nm wavelength range. Atomic N and O emission lines are present at 740 – 750 nm and ~ 777 nm.

Conclusion and Outlook

In-situ LIBS analysis of Fe particle surfaces during thermochemical oxidation requires minimizing gas-phase transfer to measure the particle O content accurately. Picosecond-pulse lasers reduce plasma lifetime and gas-phase contributions, yielding Fe and O signals of similar magnitude for pure Fe particles. Nanosecond-pulse excitation produces larger uncertainty due to high gas-phase O interference.

Acknowledgement

DFG (503997890, 514177753), ERDF (21188701)

References

[1] Bergthorson JM, Goroshin S, Soo MJ, Julien P, Palecka J, Frost DL et al. Direct combustion of recyclable metal fuels for zero-carbon heat and power. Applied Energy 2015;160:368–82. https://doi.org/10.1016/j.apenergy.2015.09.037

[2] Janicka J, Debiagi P, Scholtissek A, Dreizler A, Epple B, Pawellek R et al. The potential of retrofitting existing coal power plants: A case study for operation with green iron. Applied Energy 2023;339:120950. https://doi.org/10.1016/j.apenergy.2023.120950

[3] Dorscht M, Oberndorfer N, Böhm B, Dreizler A, Geyer D. Single-shot in-situ LIBS-DBI diagnostics for atomic composition analysis of iron particle surfaces in energy storage processes. Fuel 2026;403:135993. https://doi.org/10.1016/j.fuel.2025.135993

AUTHORS

Maximilian Dorscht
PhD student at University of Applied Sciences Darmstadt and Technical University of Darmstadt

Oliver Rohm
Sales Engineer at Topag Lasertechnik

Prof. Dirk Geyer
Professor at University of Applied Sciences Darmstadt

CONTACTS

University of Applied Sciences Darmstadt, Germany
Topag Lasertechnik GmbH, Darmstadt, Germany

A Usable Workflow in Optical Metrology

Handheld Scanner Improves Certainty in Everyday Quality Control

The Evo Series provides unparalleled metrology-grade accuracy and unmatched user experience.

In modern manufacturing, where complex geometries and reflective or composite surfaces are routine, handheld metrology must do more than capture points. Engineers need repeatable, traceable data without depending solely on CMM availability. A recently launched handheld scanner was developed for this: a usable approach to optical metrology that keeps verification close to production.

The recently launched Handyscan 3D Evo Series evolves a platform by combining accredited performance with on-scanner guidance. Acceptance testing are based on ISO 10360, and calibration is performed in ISO/IEC 17025 accredited laboratories, so scan-derived conclusions can be audited like traditional measurements. For engineers who weigh method as much as result, this framing shifts the question from "Is the scan good?" to "What does it say about the part or the process?"

A defining change is the embedded Gui with a 4.3 inch onboard display. Operators see mesh generation, coverage indicators, and key parameters directly on the device, reducing attention shifts between scanner and workstation. Real-time cues help ensure complete data on features that drive tolerance decisions. The effect is a steadier, guided acquisition rhythm that different teams can reproduce with less variability.

Enhancing Confidence

The platform also integrates augmented reality for in-situ verification. AR overlays mesh or colormap information directly on the part, while auto-alignment and automatic cleanup accelerate registration to CAD. Engineers can separate true deviations from acquisition artifacts at the point of capture, cutting rescans and post-processing. A built-in photo camera also supports documentation and communication, linking images to the captured geometry when needed.

With 46 blue laser lines, real-time calibration, accuracy of 0.020 mm, and volumetric accuracy of 0.020 mm + 0.015 mm/m, the Evo Series addresses typical tolerances in sheet metal, machined components, and composite substructures. The intent, however, is not maximal specifications in isolation but consistent performance that can be reproduced on the shop floor.


The auto-alignment feature streamlines repetitive inspections.

Embedding Guidance at the Point of Capture

Paired with the mobility kit, the Evo series operates wirelessly, freeing operators from long cables when working around large tools, fixtures, or assemblies. Because guidance resides on the scanner, users can maintain focus on coverage and definition without breaking flow. For manufacturers pursuing in-station verification or containment near the line, this provides an experience that is fast to deploy, quick to repeat, and easier to sustain during shifts.

AUTHOR
Pierre-Luc Delagrave
Product Manager at Creaform

CONTACTS
Creaform Inc., Lévis, Canada

Weld Seam Inspection Through Optical Coherence Tomography

Efficient Quality Assurance in Gas Metal Arc Welding

A stand-alone sensor system uses optical coherence tomography as a measurement method for continuous seam tracking and inspection in real time for gas metal arc welding processes. Optical coherence tomography (OCT) methods are more precise than conventional camera technology and the effort required for subsequent quality control is reduced.

Image: Lessmüller Lasertechnik

Gas metal arc welding, or GMAW, is widely used in the metalworking industry, in container and tank construction, in mechanical engineering, in rail vehicle and shipbuilding, but also in the furniture industry. The process enables the joining of thin sheets as well as components with material thicknesses of up to 60 millimeters and is often used fully automatically and robot-guided in industrial environments.

In order to improve the productivity of automated GMAW welding and to reduce scrap caused by insufficient fusion of the welded joint, the welding process must be precisely controlled. Due to the high demands of robot-guided arc welding, previous process monitoring systems—with laser triangulation and CMOS cameras—are often considered inadequate. Lessmüller Lasertechnik's OCT technology now enables efficient quality assurance in arc welding.

Better Tracking and Significant Time Savings

Similar to laser beam welding, the OCT 250 stand-alone welding sensor technology also enables pre-process seam tracking and post-process seam inspection during the ongoing welding process in automated MSG welding.

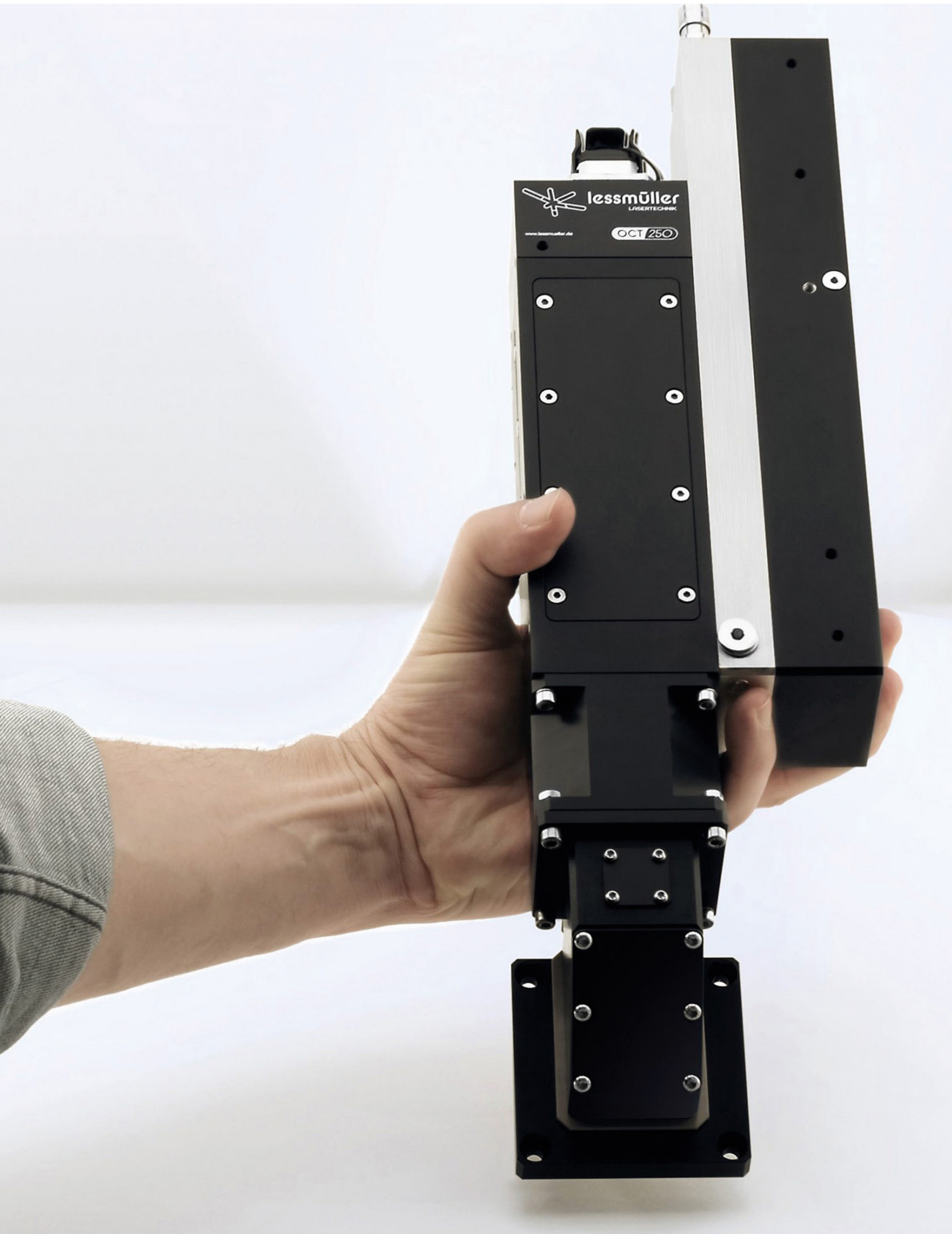


Image: Lessmüller Lasertechnik

The OCT 250 stand-alone sensor system uses optical coherence tomography (OCT) as a measurement method for continuous seam tracking and weld seam inspection in real time for automated GMAW processes.

Unlike conventional process monitoring systems with camera technology, the OCT sensor is insensitive to direct or diffuse light and blinding. It works reliably despite the arc itself, ambient lighting, and reflective welding spatter. This insensitivity allows the measuring lines to be placed much closer to the TCP (Tool Center Point), thereby reducing passive travel distances which represent non-productive time.

The OCT scanner can be mounted directly on a robot-guided welding torch. For process monitoring, the system projects two OCT scan lines near the TCP. The first, ahead of the wire, captures the geometry to be welded and, if necessary, measures the dimensions of the gap. The second scan line runs behind the torch nozzle (after the arc) and scans the weld bead. This captures and maps quantitative and qualitative data such as weld seam length, profile, width, area, and groove of the weld bead, convexity and concavity of the seam surface, undercuts and other defects, as well as surface porosity and craters.

Evaluation and Documentation of Analysis Data

The application software allows all data relating to seam guidance and inspection quality assurance to be visualized, evaluated, and archived for tracking purposes. Based on the preceding seam tracking, the client software can issue control commands via fieldbus to the machine or robot control system and correct the robot's program sequence. For example, displacements, the welding angle, or a combination of both can be adjusted and individually tailored to the respective joint type, the gap and overlap size. The evaluation of the post-process seam inspection allows comparison with predefined tolerances and, if critical errors are detected, can mark the components as rejects and even abort the welding process. This eliminates the effort and necessity of additional downstream quality controls.

Conclusion

The OCT 250 stand-alone sensor system is a space-saving, and easy-to-integrate process and quality monitoring solution for automated GMAW. Users can avoid production downtime, ensure high welding quality, and increase the productivity of their welding processes. The reliability and industrial suitability of the system has already been demonstrated in several test applications at research institutes and Tier 1 automotive suppliers.

CONTACTS
Lessmüller Lasertechnik GmbH, München, Germany

Fresnel Lenses as an Economic Alternative to Aspheric Lenses

Optical Components in Large Quantities for Illumination Systems

Fresnel lenses can be used for a variety of tasks in industrial applications. New design algorithms enable the creation of unusual shapes. Due to advances in engineering and manufacturing, these optical components are now manufactured in large-scale production. Thus, Fresnel lenses represent an economic alternative to aspheric lenses.

Lens in Fresnel technology

In machine vision systems, optimal illumination is essential. Illumination modules based on Fresnel lenses feature optical components that are tailored for industrial use. Advantages of these lenses are their low weight and their small dimensions. The low mass results in low costs.

The surface of Fresnel lenses might be considered as an alternating sequence of facets that direct the light into the desired direction and those that do not contribute. This implies that the efficiency is somewhat lower than the efficiency of a comparable aspheric lens. In many applications in inspection systems, the multiple advantages outweigh this disadvantage

Possibility of Different Refractive Structures

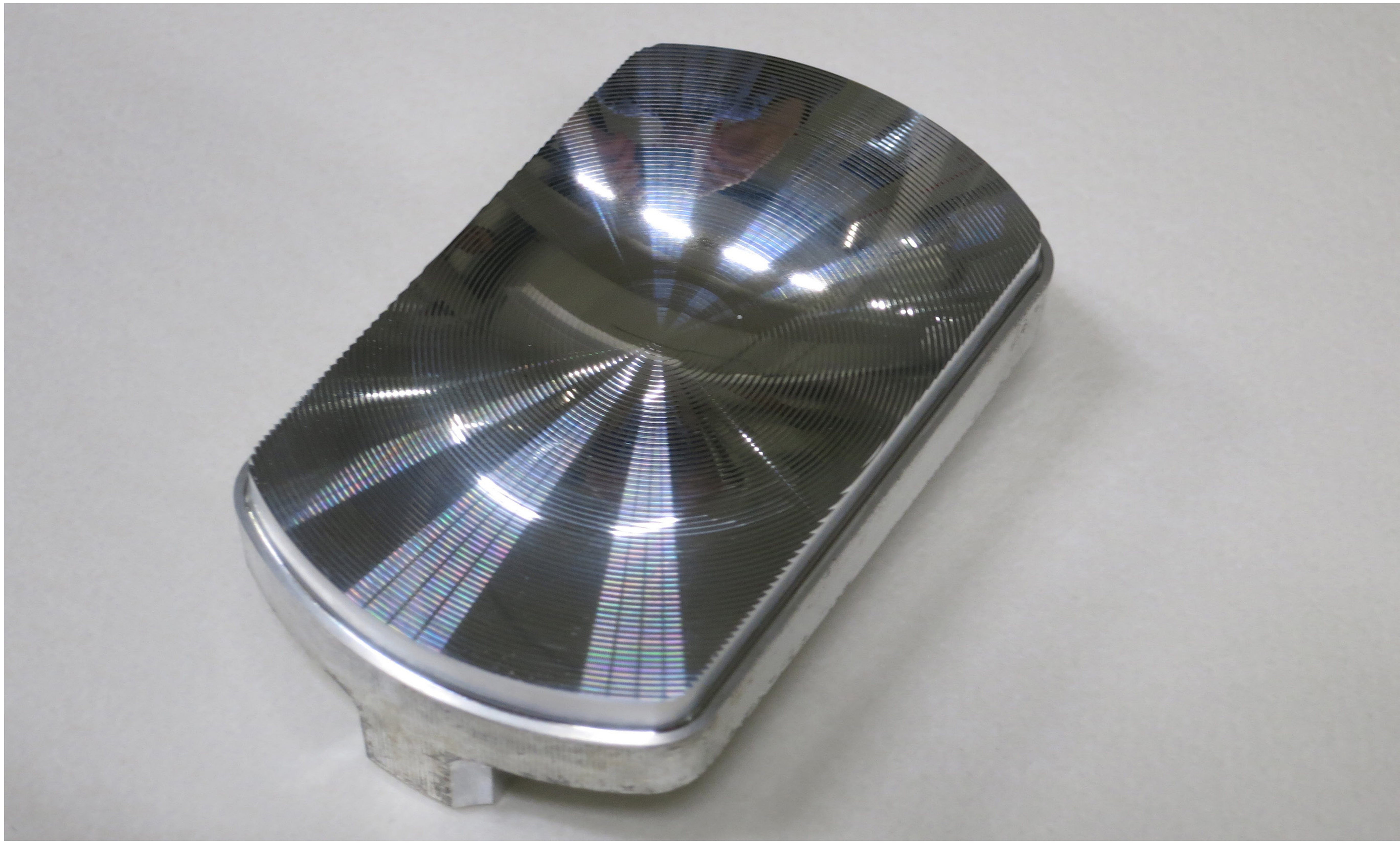
In industrial applications as inspection, an illumination with high homogeneity is important. It is the prerequisite that deviations or defective parts can be detected reliably. Using Fresnel lenses, a high homogeneity can be obtained. They are well suited to be employed in collimation optics, and allow to obtain a high degree of collimation.

Some tasks require structured illumination. It might be that the intensity should vary according to a prescribed function. Or a region of interest has to be emphasized against a peripheral background. To realize a scenario with structured illumination, Fresnel technology offers the advantage that a divided aperture is feasible. Partial areas can be provided with different refractive structures that feature different functionalities.

A Variety of Geometries

The variety of applications comes together with a variety of possible forms:

- A flat lens with the refractive structure on its outer surface is probably the most common variant. A refractive structure on the inner surface is also possible. In some applications, a smooth exterior has advantages.
- A Fresnel lens with equidistant surfaces, but with a slight curvature might also have advantages, for example, in obtaining higher thermo-mechanical stability.
- Dome lenses are a technical specialty. They also feature a reduction of material, because they are hollow. Because the Fresnel structure is on a curved surface on the inner side of the lens, special algorithms have to be used for the optical design.

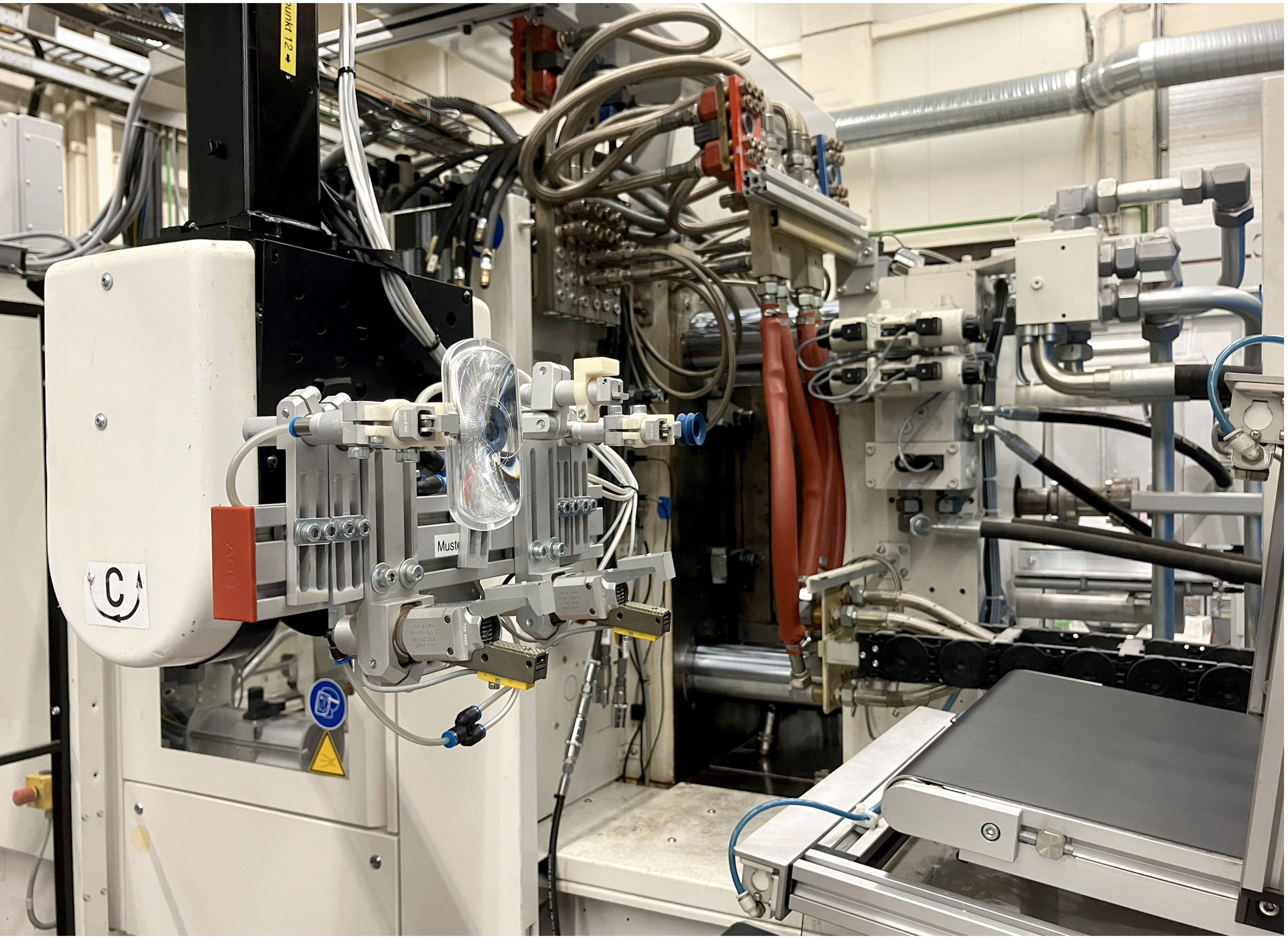


Metallic insert used as master in the replication process

- A device for circular illumination can be realized by a ring-shaped array of medium-sized Fresnel lenses.
- To address some illumination tasks, a strong deviation of the lens from rotational symmetry might be necessary. An example is the homogeneous illumination of a surface with a high aspect ratio. Such lenses, which correspond to anamorphic aspheric lenses, can also be implemented using Fresnel technology.

Design Aspects

The client-specific design of the illumination unit consisting of LED and Fresnel lenses is performed with modern optics software. Standard software is complemented by proprietary algorithms to be able to offer tailored solutions. The Fresnel lens is adapted to the illumination task and optimized with respect to efficiency as well as with respect to other customer requirements such as homogeneity of the light distribution.



Injection molded Fresnel lens

Lenses can also be produced according to design data provided by the customer.

Depending on the wavelength range, Fresnel lenses made from polymers are also an option for laser-based systems, especially as collimation optics.

It is an advantage of flat refractive structures that they enable the integration of two functions in a single component. The corresponding sub-structures are designed using different algorithms.

Modern Injection Molding Technology

The production of Fresnel lenses is made possible by progress in precision CNC machining. This technology is used to manufacture form inserts that carry the precise structural data of the lens surface. They are inserted into the injection molding machines, in which Fresnel lenses are replicated in large-scale production. The lenses are made from transparent plastic. Common polymeric materials used in injection molding are polycarbonate and polymethylmethacrylate. Compared to other types of lenses, the cycle times are rather short for Fresnel lenses.

Depending on the parameter set used in injection molding, components can be produced that feature high robustness and can be employed under adverse conditions such as low or high temperatures. Of course, the use of polymeric materials sets physical limits here. But during recent development activities, the range in which Fresnel lenses could be applied was extended. The robustness of the product is checked and verified on a routine basis using climate cabinets to expose sample lenses to adverse conditions.

AUTHOR
Gerhard Kloos
Product Designer in the
Business Group Lighting of Forvia Hella

CONTACTS
Forvia Hella, Business Group Lighting,
Lippstadt, Germany

Active Alignment in Assembly and Connection Technology

Manufacturing Highly Integrated Photonics and Optoelectronics Systems

Reliable manufacturing processes are essential for the assembly and interconnection technology of photonics and optoelectronics systems. One company, for example, uses active alignment during assembly—a method in which the actual maximum light coupling performance is achieved.

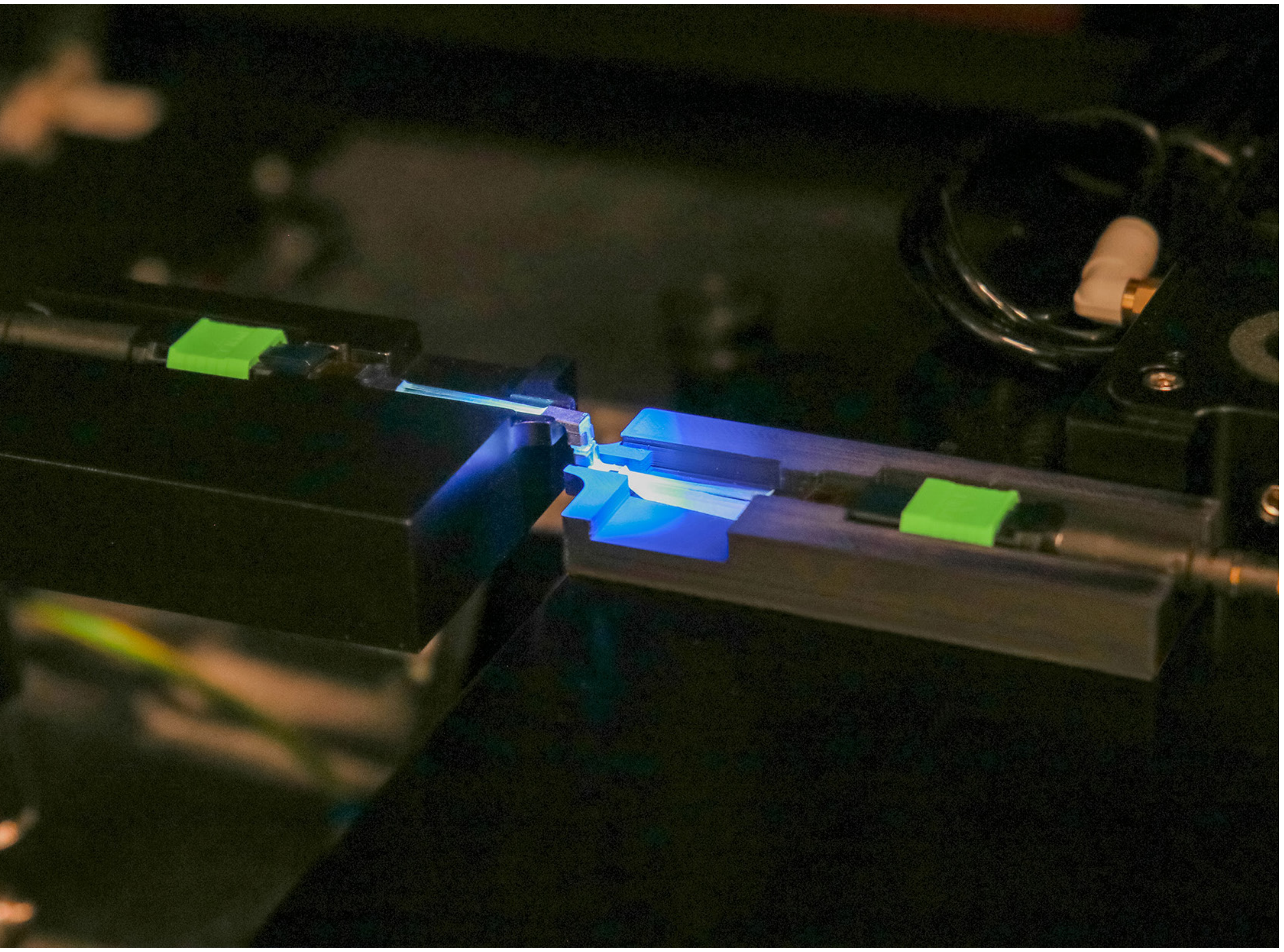


Image: Tresky

Fiber optic communication enables encrypted data transmission in civilian, industrial, and military environments. Lidar systems in autonomous vehicles capture their surroundings with the highest precision. Photonics is also an indispensable component for new applications in aerospace, medical technology, and quantum technology. Optical sensing, laser based distance measurement, and optical neural networks for AI driven systems require not only high technological standards but also reliable manufacturing processes.

A key role within these processes is played by active alignment technology. In contrast to passive alignment—where components are positioned according to geometric features—active alignment relies on signal feedback during assembly. This approach ensures not only geometric centering but also alignment to the actual maximum of light coupling. Such precision is especially critical in applications involving single mode fibers or silicon photonics systems, where even minimal deviations can lead to losses. Hybrid modules with multiple optical interfaces and non standard geometries also benefit from this alignment strategy. Tresky Automation combines nanometer level accuracy with flexible assembly methods across various coupling processes.

Tresky´s machine platforms cover the whole workflow—from component positioning and optical alignment to final bonding. Customer specific requirements as well as future scalability are taken into account. This results in manufacturing solutions suitable for research and development as well as for series production.

What coupling processes exist? Here is an overview of the seven most common methods.

CONTACTS
Tresky GmbH, Hennigsdorf, Germany

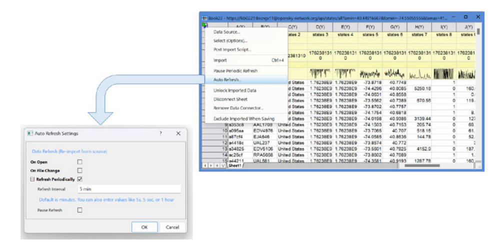
Products

p. 24

Kinematic Mounts for Precision Optics

Edmund Optics

p. 24



Efficient Data Analysis and Advanced Visualization Options

Additive

p. 25

Precise Tilting Mirrors for Laser Beam Deflection

Micro-Epsilon

p. 25

Advanced Measurement Technology for AR Optics

Trioptics

p. 26

Beam Profile Meter With Wide Wavelength Range

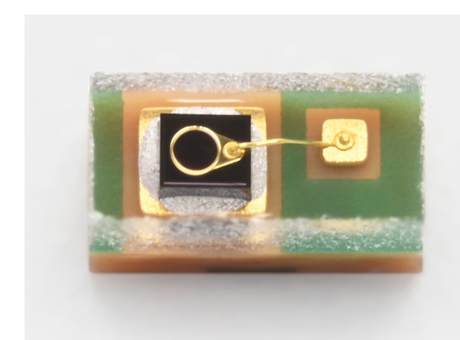
MKS

p. 26

Precise Laser Processing With Scalable Galvo Scanners

Aerotech

p. 27



Miniaturized InGaAs APDs

Hamamatsu

p. 27

Compact SWIR Light Source for OCT

Superlight

p. 28

Series of Ti:sapphire Lasers

Hübner

p. 28

Epoxy Adhesive System for Precise Photonics and Quantum Computing Applications

Nanosystec

Kinematic Mounts for Precision Optics

Edmund Optics expands its optomechanics offering with high-precision kinematic mounts that enable seamless system integration. These mounts are compatible with Edmund Optics' optomechanical and optical components, simplifying the creation of complete optical systems.

Integrating mounts and optics from a single source reduces alignment issues and speeds up time to market. Edmund Optics offers over 34,000 products, global technical support, and decades of experience in optical engineering.

The mounts are suitable for companies developing high-performance or thermally sensitive systems. Edmund Optics combines laser-grade optics and precision mounts for readily available, compatible solutions. The company offers both an extensive product catalog and custom manufacturing services for specific customer requirements.

Image: Edmund Optics

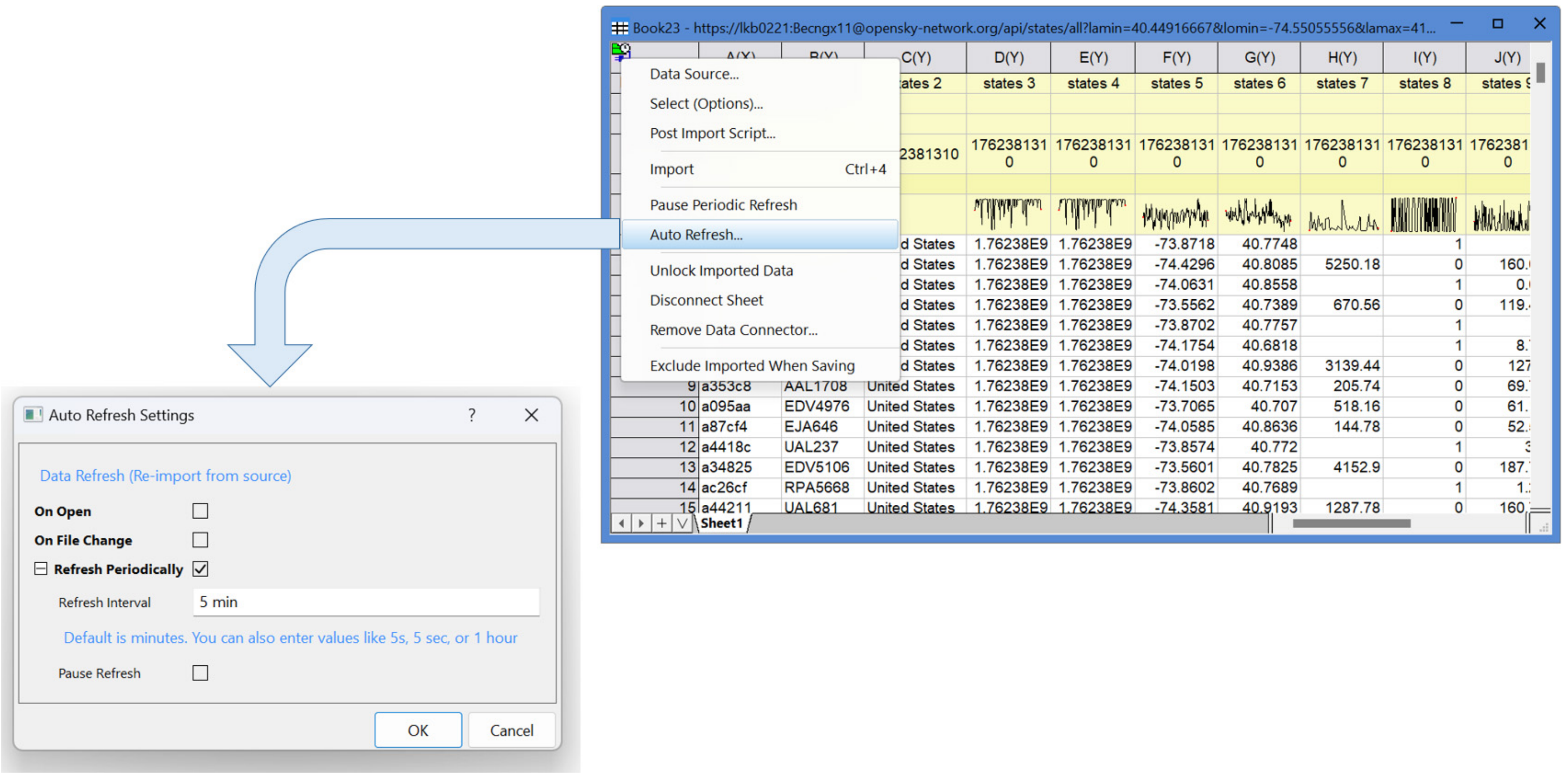


Image: Additive

Efficient Data Analysis and Advanced Visualization Options

With Originpro 2026 from Additive, Originlab improves the efficiency and scope of data analysis and visualization. The software reduces the amount of work required by introducing flash previews and smart formulas that speed up data cleaning. Users can directly import Excel formulas to continue workflows seamlessly. New features in the area of quality statistics, such as graphical summaries and the Anderson-Darling test, enable quick identification of trends and outliers. The enhanced Graph Maker now supports categories and groups, enabling targeted creation of graphics. Version 2026 offers new chart types, including cause-and-effect charts and decision trees. New apps such as Reliability and Survival Analysis and optimized apps such as Design of Experiments expand the functionality.

Precise Tilting Mirrors for Laser Beam Deflection

Micro-Epsilon's Fast Steering Mirrors (FSM) are miniaturized tilting mirrors that enable precise laser beam deflection. The FSM3000 series combines high precision with dynamics and is robust and easy to integrate, making it ideal for industry, optics, aerospace, and defense. These micromechatronic systems use voice coil technology to achieve a frequency of up to 2 kHz. The movement range of ± 1.5° offers flexibility with consistent accuracy. The systems use eddy current displacement sensors and a flat mirror that is moved by electromagnetic coils to ensure precise two-axis control. Weighing only 55 g, the tilting mirrors are resilient and can withstand shocks and vibrations during rocket launch. Micro-Epsilon offers a broad portfolio ranging from standard to customized adaptations to OEM developments to meet specific requirements.

Image: Micro-Epsilon

Advanced Measurement Technology for AR Optics

Trioptics has improved waveguide measurement technology for augmented reality optics with Imagemaster Lab AR Flex. New upgrades enable comprehensive evaluation of imaging quality, including MTF, distortion, color, luminance, veiling glare, and relative efficiency, with a single system. This integration simplifies workflow and increases productivity. Imagemaster Lab AR Flex uses advanced spectrometry and photometric filters to deliver accurate and reliable results. The upgrades address the growing complexity of AR waveguide technology by detecting subtle imperfections that can compromise the immersive experience. Parameters such as veiling glare and relative flux are measured to ensure an uninterrupted experience. Existing users can seamlessly integrate these upgrades.

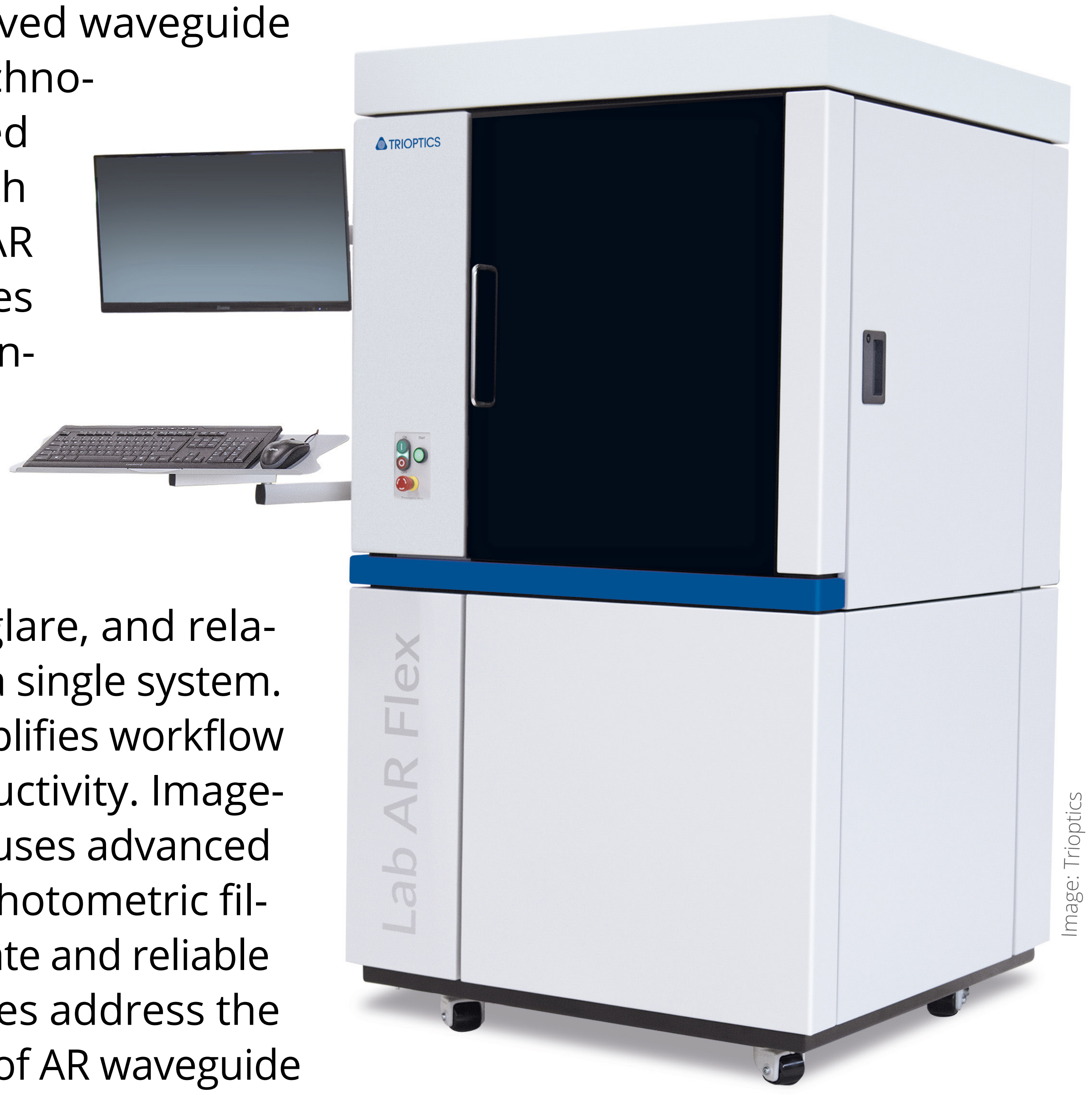


Image: Trioptics

Beam Profile Meter With Wide Wavelength Range

The Ophir SP301Q CQD beam profile meter from MKS offers a cost-effective alternative to InGaAs sensors for beam profile measurement in the near and short-wave infrared as well as in the visible spectrum. Based on colloidal quantum dots (CQD), it offers comparable accuracy and resolution, but is less expensive and not subject to ITAR restrictions. The device covers a wavelength range from 400 nm to 1,700 nm and is particularly suitable for short-wave infrared lasers. With a resolution of 640 × 512 pixels and an active area of 9.6 mm × 7.7 mm, it is suitable for detailed analysis of laser beams in industrial and military applications. The integrated Ophir BeamGage Professional software supports precise, ISO-compliant beam measurements and offers features such as advanced image processing and data logging. A GigE interface enables fast data transfer and easy integration into industrial networks.

Image: MKS

Image: Aerotech

Laser Processing with Scalable Galvo Scanners

Aerotech presents the AGV-CPO series, highly dynamic 2-axis laser scan heads designed for precise laser applications. These compact systems offer 22 bit resolution and minimal thermal drift, ideal for research and industrial precision machining. Available with 10, 14, or 20 mm apertures, the AGV-CPO models are based on the core architecture and feature digital encoders for improved accuracy. External control electronics provide thermal decoupling and position stability. Optional water and air cooling support thermal stability. Uniform control via the Automation1 platform enables seamless process scaling. The AGV-CPO series offers a cost-effective solution for micromaterial processing, laser texturing, and high-speed applications, combined with flexible integration and efficient cabling for high precision and ease of use.

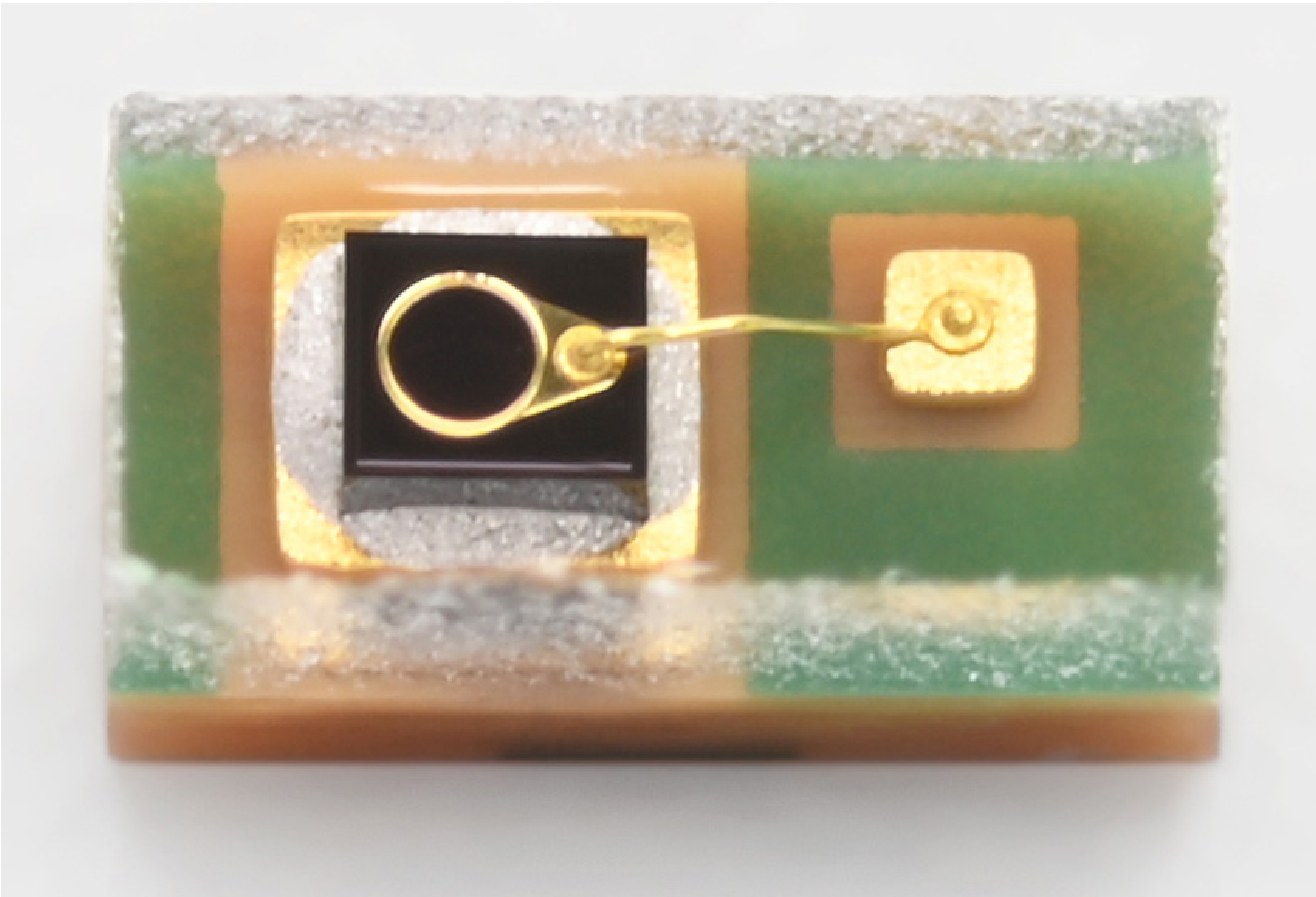


Image: Hamamatsu

Miniaturized InGaAs APDs

Hamamatsu Photonics introduces the G15978-0020P InGaAs avalanche photodiode, which has been specially developed for precise distance measurements and the detection of weak light signals. This innovative miniaturized APD is suitable for mobile applications and meets the requirements of research, industry, and OEM customers.

The surface-mounted COB package reduces the size, making it easier to integrate into compact devices. Key features include a compact design measuring only 1.6 mm × 0.8 mm × 0.7 mm, a minimum dark current of 50 nA, and a low capacitance of 2.0 pF for fast response times. Increased sensitivity at a wavelength of 1,550 nm and RoHS-compliant production underscore the product's environmental friendliness and robustness. Designed for applications such as touchless displays and wireless communication, the G15978-0020P offers reliable performance and supports miniaturization in sensor technology.

Compact SWIR Light Source for OCT

Superlight Photonics presents the SLP-2000, a compact SWIR supercontinuum laser light source that expands the company's portfolio of broadband light sources. The SLP-2000 offers spectral coverage from 950 - 1,350 nm, ideal for next-generation OCT, biomedical imaging, and industrial metrology. Designed for stationary and mobile integration, the SLP-2000 features an ultra-low-noise output in a maintenance-free format. The spectral distribution is tuned to InGaAs detectors, making it particularly efficient for non-destructive, high-resolution real-time OCT applications. With PAD technology, it delivers a coherent broadband signal suitable for OEM and instrument integration. Coverage of the OCT wavelengths 1,060 nm and 1,300 nm enables deeper tissue penetration and improved contrast. In industrial applications, the SLP-2000 offers high performance for non-destructive testing, layer thickness measurements, and 3D imaging of transparent materials.

Image: Superlight

Series of Ti:sapphire Lasers

Hübner Photonics presents the C-Wave BTS, a single-frequency, continuously tunable Ti:sapphire laser with a wavelength coverage of 700 to 1,000 nm and a power output of up to 4 W. This laser offers automation and ease of use and complements the existing C-Wave product line, which is known for its wide coverage of single-frequency, tunable cw laser light. The C-Wave BTS is based on the robust hardware platform used worldwide in laboratories and by industrial customers, allowing researchers to focus on their experiments. It offers new possibilities in spectroscopy, particularly in resonant Raman spectroscopy, as well as in quantum materials research. Together with the C-Wave VIS and GTR models, which are based on OPO technology, the series covers the entire visible spectrum from 450 nm to 3.4 µm.

Image: Hübner

Image: Nanosystec

Epoxy Adhesive System for Precise Photonics and Quantum Computing Applications

In photonics manufacturing, the precise alignment and permanent fixation of optoelectronic components is crucial. Nanoglue, an epoxy adhesive system from Nanosystec, enables the universal and reliable processing of demanding materials. Unlike traditional joining methods, which require metallic contact surfaces, Nanoglue allows different material combinations to be joined, which is particularly advantageous in hybrid architectures of optical modules. Nanoglue offers electrical insulation and dimensional stability over a wide temperature range, especially for photonic subsystems and cryogenic environments. The system combines active alignment with precise epoxy application to fix components in position with nanometer-level stability. The modular system technology and cost-effective adhesives offer economic advantages. Nanoglue can be integrated flexibly and supports the increasing optical integration density and relevance of optoelectronic components.

Index

Company	Page
Additive	24
Aerotech	26
Aikidovation	5
Cobolt	5
Creaform	15
Deutsche Gesellschaft für Angewandte Optik	6
Edmund Optics	24
EPIC European Photonics Industry Consortium	8
Fisba	4
Hamamatsu Photonics	27
Hella	19
Hübner Photonics	28
Laytec	8
Lessmüller Lasertechnik	17
Messe Erfurt	3
Micro-Epsilon	25
MKS	26
Nanosystec	28
Physik Instrumente	5
Spectaris Deutscher Industrieverband für Optik, Photonik, Analysen- und Medizintechnik e.V.	4
Superlight Photonics	27
Topag	cover page, 4, 11
Tresky	22
Trioptics	25

Imprint

Published by
Wiley-VCH GmbH
Boschstraße 12
69469 Weinheim, Germany
Tel: +49/6201/606-0

Managing Directors
Dr. Guido F. Herrmann

Publishing Director
Steffen Ebert

Product Management
Anke Grytzka-Weinhold
Tel: +49/6201/606-456
agrytzka@wiley.com

Editor-in-Chief
David Löh
Tel: +49/6201/606-771
david.loeh@wiley.com

Editorial
Andreas Grösslein
Tel: +49/6201/606-718
andreas.groesslein@wiley.com

Stephanie Nickl
Tel: +49/6201/606-030
snickl2@wiley.com

Commercial Manager
Jörg Wüllner
Tel: +49/6201/606-748
jwuellner@wiley.com

Sales Representatives
Martin Fettig
Tel: +49/721/14508044
m.fettig@das-medienquartier.de

Alexandra Wojtanowska
Tel: +49/6201/606-552
awojtanows@wiley.com

Sales Team Lead
Miryam Reubold
Tel: +49/6201/606-127
miryam.reubold@wiley.com

Design
Oliver Haja
ohaja@wiley.com