PRESS RELEASE

AKL'18: Lasers Conquer Large-Scale Manufacturing

Visitors to this year's AKL – International Laser Technology Congress in Aachen, Germany, had the unique chance to see where industrial laser technology stands today and where it will be tomorrow. The congress delivered the full picture of current technologies, from advanced laser sources and new process technologies to a wide range of applications such as Additive Manufacturing or even Quantum Sensing. To research such future topics, several projects have been started, and a whole new "I³ – Integrated Interdisciplinary Institute" has been inaugurated.

From May 2–4, the laser community convened for the twelfth time at the AKL – International Laser Technology Congress in Aachen. The 661 attendees, representing industrial laser manufacturers and users, met to enjoy a densely packed program with 77 presentations, a festive ceremony for the Innovation Award Laser Technology 2018, and a number of important project kick-offs. Separate events offered insights to laser novices (Laser Technology ABC's) and business people (Technology Business Day).

The conference was accompanied by a sponsors' exhibition featuring 56 renowned laser technology brands. As usual, the exhibition hall was a lively place for networking and direct conversation with the various experts. For even more technical insights and one-on-one exchange, Fraunhofer ILT opened its labs for "Laser Technology Live", an open house event with more than 100 live demonstrations at Europe's largest laser application center.

Innovation Award for a Multi-Spot Module for Laser Welding

A very special highlight of the AKL'18 was the ceremony for the Innovation Award Laser Technology. The festive dinner and ceremony for this European prize for applied research are held every two years in the ancient Coronation Hall of Aachen's town hall. The award was initiated by the associations Arbeitskreis Lasertechnik e. V. and the European Laser Institute e. V. (ELI) and offers 10,000 euros in prize money.

This year's first prize was presented to Dr. Axel Luft (Laserline GmbH) and his team for "Multi-Spot Modules to Improve Joining Processes due to Tailored Spot Geometries". The invention had started with a technological challenge at Volkswagen: Hot-dip galvanized sheets have superior surface quality, but when jointed via laser brazing, the quality of the joint itself decreased; it was rougher, and in areas close to the joints, spatters increasingly occurred.

Editorial Notes
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To address these challenges, a team of experts from Laserline, Volkswagen and Scansonic developed a multi-spot module including an optical camera tool for a spot-in-spot design. Volkswagen qualified the triple-spot module as the preferred solution for hot-dip galvanized materials in series production, and another 40 systems have already been sold.

The second prize was awarded to a team led by Dr. Gerald Jenke (Saueressig GmbH + Co. KG) for "Multi Parallel Ultrafast Laser Ablation for Large Scale Ultraprecision Manufacturing" while the third prize went to a Spanish team represented by M. Sc. Eng. Alejandro Bárcena (Talens Systems S.L. Etxe-Tar Group). Their project "RAIO DSS: A High Flexibility Dynamic Beam Control System for Laser Heat Treatment and Related High Power Laser Applications" provides a new method for the flexible customization of laser beam patterns. Initially, the system was developed for customized laser hardening of automotive components.

Status and Limitations of Current Systems for Process Control

The three-day congress started with two special symposia on "Process Control" and "Laser Additive Manufacturing". In particular, for large-scale manufacturing, process control needs to fulfill several crucial functions. First, there is quality control, which includes several tests of whether parameters such as the dimensions of the workpiece fall within predefined limits. Quality control is performed before, during, and after a process. Dr. Thomas Grünberger from plasmo Industrietechnik GmbH gave a review of a wide range of available sensors for this purpose.

In a second step, these data can be used to document all the workpiece parameters and all the process parameters for every workpiece and every weld seam. As a requirement of Industrie 4.0, this data set is made available for quality, throughput, and maintenance monitoring throughout production.

As Michal Ungers from Scansonic MI GmbH showed for joining applications, there is a third possible function of process control systems: process optimization. Given a measured deviation from target parameters, the process parameters can be changed by the process control system until an optimum is reached. This teaching process creates an optimized set of process parameters that is stored in the machine as a software upgrade. It turns out that such closed-loop optimization works well in metal joining processes.

Closed-loop process control is even more desirable but is not yet available for Additive Manufacturing (AM). This will be one of the major challenges to work on in the coming years. With about 70 percent market growth last year, Additive Manufacturing made a big leap towards mass manufacturing. This was nicely illustrated by the new BMW i8 Roadster exhibited at the congress. It is the first car to feature AM parts in automotive serial manufacturing. As BMW's Maximilian Meixlsperger explained in the shown

application, AM is an economical solution up to a batch size of 60,000 parts compared to pressure die casting.

Thoughts about Future Laser Markets from its Four Biggest Players

The "Laser Technology Conference" on May 3–4 was divided into three tracks: Laser Material Processing – Macro, Laser Material Processing – Micro, and Laser Beam Sources. They all began with the plenary Gerd Herziger Session. This session, named after the founder of the Fraunhofer Institute for Laser Technology ILT, presents strategic insights into laser technology.

This year, the session opened with the famous tunes of Dave Brubeck's "Take Five". The institute's director, Prof. Reinhart Poprawe, had asked each of the four speakers to present five elements that matter for the future of industrial laser technology. Dr. Peter Leibinger (TRUMPF GmbH + Co. KG) spoke about the pressure from tough competition as an incentive for innovation. Innovation has been a major driver of TRUMPF's success in the past, so he sees good opportunities for his company to become the largest laser manufacturer again within a few years.

Dr. Mark Sobey, from the current champion COHERENT Inc., drew a rather optimistic picture of the future laser market: both, smartphones and smart cars possess market opportunities in excess of $1 billion for laser technology. Dr. Evgene Scherbakov (IPG Laser GmbH) added his success recipe of vertical integration, and finally, Dr. Qitao Lue (Han's Laser Technology Industry Group Co., Ltd.) presented the Chinese laser market as both the biggest challenge and the biggest opportunity for laser manufacturers in the future.

From Record Lasers to Record Cutting Machines

The three major tracks of the conference highlighted a large number of innovations in laser technology. While the laser market is growing at record rates, there has been a long-term shift in interest from laser sources towards process technology and applications. The pressure for higher productivity is leading to stronger digitization or fully digital photonic production, as presented by Prof. Reinhart Poprawe in a special session for all the participants.

Still, the field of laser beam sources has given rise to a number of remarkable innovations. In particular, high-power diode and ultra-short pulsed (USP) laser solutions have attracted a lot of interest. While USP lasers have matured in the region of about 50 watt power, larger versions with several hundred watts of power are expected to enter mass manufacturing very soon, as Dr. Clemens Hönninger (Amplitude Systèmes) and Dr. Torsten Mans (AMPHOS GmbH) pointed out.

New blue diode laser systems were introduced by Volker Krause (Laserline GmbH). Funded by the German Federal Ministry of Education and Research (BMBF), they joined with OSRAM and other partners to develop a fiber-coupled cw laser system with a 1 kW output power. At 450 nm, the radiation from these lasers is absorbed much better by copper than fiber- or disk-laser radiation at 1 micron. Thus, Laserline's first targeted application is copper welding. Blue light is very well transmitted by water, so this system may offer further benefits for the underwater operation of water-jet-guided laser processes.

Cutting and welding enjoy the highest popularity among users of industrial laser technology. Still, there are ever-growing demands for more productivity and processing speed. One outstanding example of this trend was presented by Izuru Hori (Honda Engineering Co., Ltd.). Together with Fraunhofer ILT, Honda developed a high-speed laser cutting technology to provide up to 19,000 sheets per day for the automotive industry – the equivalent of 40 km of flat sheets. The system uses a special gantry in which two 8.5 kW servo motors move the cutting head with up to 10 g acceleration. "Our system cuts even large side plates with a total length of 9 meters within 7 seconds," Hori explained in Aachen. With the new system, Honda was able to realize cutting speeds of up to 300 m/min. They increased their productivity by a factor of 10.

One of the last sessions of the conferences focused on a highly debated future topic: Quantum Technologies. In that field, it is Quantum Sensing that currently attracts a lot of interest. Dr. Robert Rölver (Robert Bosch GmbH) discussed Bosch's activities in the field, in particular when using nitrogen vacancy (NV) centers in diamonds. NV magnetometers are in testing already, and given their unique sensitivity to small currents, they promise a wide range of new applications in technical and life-science applications.

Fraunhofer Cluster of Excellence develops 20 kW Femtosecond Laser

Femtosecond or ultra-short pulsed (USP) lasers in general have a long history of development from a pure academic research tool towards a reliable industrial technology. While the technology for sub-100-W sources evolves, a cluster of 12 Fraunhofer institutes plans to lift the laser source technology as well as the process technology to an entirely new level.

Parallel to AKL'18, a new Fraunhofer Cluster of Excellence Advanced Photon Sources CAPS was officially started. The cluster plans to develop a new generation of USP lasers with up to 20 kW power by 2022. The 20 million euro project is governed by the Fraunhofer Institutes for Laser Technology ILT and for Applied Optics and Precision Engineering IOF. Both institutes join their laser development capabilities and provide two application labs in Jena and Aachen where the other 10 partners can immediately start to test and improve their application technology.

Launch of the "I³-Research Center for Digital Photonic Production"

On the evening of May 3, Prof. Reinhart Poprawe, the chair for Laser Technology LLT at RWTH Aachen University and the director of the Fraunhofer ILT, started a new and trend-setting form of interdisciplinary university collaboration within the "I³-Research Center for Digital Photonic Production" (RCDPP). At this Integrated Interdisciplinary Institute, I³ for short, researchers from 17 institutes across 6 faculties of the RWTH Aachen University will conduct research together on the use of the unique physical properties of photons for the production of the future.

In autumn 2018, a so called Research Building, which is financed by the federal government and state of North-Rhine Westphalia, will be home to some 80 scientists of these RWTH institutes on over 4,300 m² of laboratories and floor space.
The research of the interdisciplinary I³-RCDPP teams will complement the research program of the BMBF-funded "Digital Photonic Production DPP Research Campus", located in the adjacent privately funded Industry Building DPP, opened in 2016.

Additionally, those two facilities within the Photonics Cluster at the RWTH Aachen Campus also complement the application-oriented approach of the Fraunhofer institutes, which are within walking distance. When Prof. Reinhart Poprawe retires next year, he will hand over an extensive infrastructure and a counterbalanced team of experts for academic and applied research that is well prepared for the efficient development of photonic solutions under the interdisciplinary requirements of the twenty-first century.

Supporting Organizations

The AKL'18 – International Laser Technology Congress is organized since 1995 by the Fraunhofer Institute for Laser Technology ILT. It is supported by input from the European Commission, the European Photonics Industry Consortium EPIC, the Arbeitskreis Lasertechnik e. V., the European Laser Institute ELI e. V., OptecNet Deutschland e. V. and the SPECTARIS, VDA, VDMA and VDI industry associations.

The laser community meets again at the AKL'20 on May 6–8, 2020 in Aachen.

Picture gallery of AKL'18: www.lasercongress.org/en/congress/gallery

Photos and more detailed information about the Innovation Award Laser Technology: www.innovation-award-laser.org

Image 1:
More than 660 attendees, representing industrial laser manufacturers and users, met to enjoy a densely packed program with 77 presentations at AKL'18 in Aachen, Germany.
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Image 2:
The plenary Gerd Herziger Session of AKL'18 – (f.l.t.r.) Prof. Reinhart Poprawe asked each of the four CEOs to present five elements that matter for the future of industrial laser technology: Dr. Evgene Scherbakov (IPG Laser GmbH), Dr. Peter Leibinger (TRUMPF GmbH + Co. KG), Dr. Mark Sobey (COHERENT Inc.) and Dr. Qitao Lue (Han's Laser Technology Industry Group Co., Ltd.).
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Image 3:
A place for vivid discussions with 56 renowned manufacturers of lasers, components and systems: the sponsors' exhibition at AKL'18.
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Image 4:
Fraunhofer ILT opened its labs for "Laser Technology Live" during AKL'18 with more than 100 live demonstrations at Europe's largest laser application center.
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Image 5:
Prof. Poprawe started the "I³-Research Center for Digital Photonic Production" (RCDPP): researchers from 17 institutes across 6 faculties of the RWTH Aachen University will conduct research together on the use of photons for industrial production.
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Image 6:
The finalists of the Innovation Award Laser Technology 2018: 1st prize for the team around Dr. Axel Luft, Laserline GmbH (front, 3.f.l.), 2nd prize for the team around Dr. Gerald Jenke, Saueressig GmbH + Co. KG (back, right) and 3rd prize for the team around M. Sc. Eng. Alejandro Bárcena, Talens Systems S.L. Etxe-Tar Group (back, 2.f.l.), presented by Prof. Reinhart Poprawe, Fraunhofer ILT (front, left), Dr. Alexander Olowinsky, ELI e. V. (back, 4.f.l.) and Dr. Ulrich Berners, Arbeitskreis Lasertechnik e. V. (front, right).
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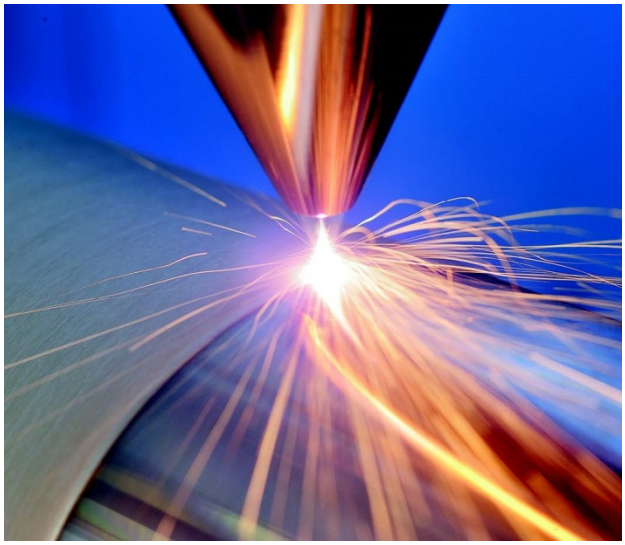

Image 7:
Technologies for Additive Manufacturing such as the extreme High-Speed Laser Material Deposition (EHLA) were a hot topic at AKL'18. © Fraunhofer ILT, Aachen, Germany / Volker Lannert.

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