

Press Release

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Networks and record-breaking lasers: The AKL'10 International Laser Technology Congress in Aachen

This was the eighth time that the Aachen-based Fraunhofer Institute for Laser Technology ILT sent out invitations – and the response they received was remarkable. More than 500 registrants attended the AKL'10 International Laser Technology Congress to find out more about the steadily expanding range of applications for the tool of light. The broad variety of topics coupled with a great opportunity for networking made this a tremendously popular event.

The AKL'10 event coincided with the celebration of various anniversaries. 50 years have passed since the American Theodore Maiman built the world's first working laser based on an invention by the Nobel Prize winners Schawlow und Townes. And it was further developments in the USA 25 years ago that sparked the founding of the Aachen-based Fraunhofer Institute for Laser Technology ILT, which has been organizing the AKL International Laser Technology Congress for some 15 years.

The year of global economic crisis left its mark, too, even on this successful market: According to David Belforte (Belforte Associates, Sturbridge, USA), worldwide revenues fell by some 20 percent in 2009. Yet the industry is showing steady signs of recovery in the USA, with sales already on the up. This trend is having a positive impact on the world market, with the US-based MAPI research Institute currently predicting growth of 16 percent for industrial high-tech production. Dipl.-Ing. Thomas Merk – Chief Operation Officer (COO) at ROFIN-SINAR Technology Inc. – also believes that things are looking up. He anticipates that the industry will take just 2 to 3 years to return to its 2008 levels (i.e. a global market volume of 6.4 billion euros for laser materials processing, with laser cutting taking a 51 percent slice). This

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goal will be achieved on the back of new technologies such as welding with diode lasers and marking with miniaturized laser systems. Although the laser is a North American invention, laser industry insider Belforte points out that it was Europe and, above all, Germany who developed it into the all-purpose tool it has become today. With competition from the Far East hotting up, however, Germany will only be able to maintain its dominant position if its laser industry systematically pushes ahead with new innovations and launches these as successful, profitable products.

This approach has already paid dividends in the aerospace industry: FANTASIA, FANTOM, DANIELA, GREENWAKE and MINERVA are the melodious names of five of a total of 11 "laser projects" – with a budget of 30 million euros – which the European Union runs as part of the FP6 and FP7 aeronautic projects. As Liam Breslin, Head of EU Aeronautics Research in Brussels, explains: "We are the only region in the world that actively supports the whole spectrum of aeronautic disciplines in such a comprehensive way." The FP7 framework program (providing a total of 2.1 billion euros of funding from 2007 to 2013) not only aims to drastically reduce noise, emissions and the risk of accidents, but also to optimize repair and manufacturing methods. To ensure that the various regions of the world do not end up taking divergent paths, the EU has entered into joint ventures with both China and Russia.

What other industries are showing promising signs for laser applications? One phenomenon that is set to shape the markets of the future is that of megatrends. According to Prof. Dr. rer. nat. Reinhart Poprawe, director of the Fraunhofer ILT, these will include topics from areas such as the environment, raw materials, health and mobility. This means that lasers will be used in all kinds of key technologies, from biotechnology, energy technology and material and medical technologies through to micro- and nanotechnology. David Belforte from the USA agrees: "Everything connected to 'green technology' will grow over the next few years." The subject of 'green photonics' also reared its head at AKL'10 in the presentation given by Prof.

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Dr. Ulrich Buller from the Executive Board of the Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. in Munich. He argues that the development of optical technologies is heavily influenced by issues of sustainability. He cited the examples of information technology (specifically 'green IT') and energy industries, in which lasers have proved to be versatile tools. One example from the Fraunhofer ILT is the use of lasers to drill 3,000 holes a second in solar cells, but attention is also being given to selective laser heating as a substitute for conventional furnace processes.

The sheer variety of current applications would have amazed the American pioneers of laser technology. There are applications to analyze mold mycotoxins, to structure laser beams and to polish the titanium components of a cardiac support system, right through to the use of lasers in 3D cinema. The 'Lasertechnik Live' event held at the Fraunhofer ILT saw the research institute's experts and collaborating RWTH Aachen University departments demonstrate innovative laser applications to a wider public in the course of more than 80 live presentations. Highlights included laser polishing of three-dimensional components, laser cladding techniques for repairing turbines, and high-performance ultra-short-pulse lasers.

Some applications involve seemingly trivial everyday tasks. The company Braun GmbH from Marktheidenfeld (a subsidiary of Procter & Gamble Germany GmbH & Co Operations oHG in Schwalbach am Taunus) faced just such a dilemma: developers were asked to find a way of dissipating the heat produced during injection molding in order to avoid any deformation of the exterior plastic casing of an electric toothbrush. The solution lay in Selective Laser Melting (SLM), a process invented by the Fraunhofer ILT in which a metal powder is introduced into the zone in which the laser radiation and component interact. The laser heats up a small portion of the base material to create a metallurgical bonding layer. Using the SLM method, the experts constructed a steel pin directly within the tool that takes the form of a spiral cooling element.

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This broad spectrum of applications can only be achieved with new lasers such as the ultra-short-pulse lasers showcased in Aachen, which provide top-quality processing results for highly demanding products in the micro-machining arena. Prof. Poprawe ranks one of the Institute's own in-house developments as the current world record-holder in its field. "Peter Rußbüldt and his team successfully combined two INNOSLAB amplifiers in such a way that, for the first time ever, the ultra-short-pulse laser produced an average output of 1.1 kilowatts with a pulse duration of 600 femtoseconds and a repetition rate of 20 megahertz", explained the director of the Fraunhofer ILT. "That corresponds to a peak pulse output of 90 megawatts – 20 million times a second!"

But innovations alone are not enough to ensure that the country, the Institute and German companies continue to maintain their keen competitive edge in the laser technology field. Smoothly functioning networks, such as the Fraunhofer-Gesellschaft's alliances and innovation clusters, also play a crucial role, according to Prof. Buller. Collaborative efforts along the supply chain can help ensure that existing resources are employed in a carefully targeted fashion. Another approach that Buller considers to be particularly effective is to pool the skills and expertise from industry, higher education and the research community within an individual region. Examples include the innovation cluster "Integrative production technology for energy-efficient turbomachinery - *TurPro*" and the Campus project set up by RWTH Aachen University. Eleven clusters have emerged there in a process of close collaboration between institutes and companies, with the Fraunhofer ILT and associated university chairs coordinating the cluster for optical technologies. The concept provides companies with many opportunities to cooperate directly with the university by establishing their own means to conduct research and development on campus. RWTH Aachen University offers direct collaboration with its more practically-oriented institutes so that work on current research issues is covered in sufficient depth and breadth. It also runs a buoyant system

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of staff exchanges designed to promote education, training and recruiting.

The concluding note of the AKL saw a bold vision laid out by the Institute's director Prof. Poprawe: "I can envisage x-ray applications which could one day enable us to fight cancer by targeting individual cells in the body with high-precision lasers."

Captions:

Fig. 1: Prof. Dr. rer. nat. Reinhart Poprawe, director of the Fraunhofer ILT. "Using a solid-state femtosecond laser, we succeeded in generating a peak pulse output of 90 megawatts 20 million times a second with an average output of 1.1 kilowatts." Source: Fraunhofer ILT.

Fig. 2: Photonics Cluster: A cluster for optical technologies is being established at RWTH Aachen Campus under the leadership of the Fraunhofer ILT.
Source: rha reicher haase + assoziierte, Aachen.

Fig. 3: A popular event: The International Laser Technology Congress – also known as AKL'10 – was held in May in Aachen, Germany and attracted over 500 delegates from industry and the research community.
Source: Fraunhofer ILT.

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