Events

# Conference Notes

## SPIE Optical Systems Design (Preview)

Barcelona, Spain, 26–29 November 2012

After Marseille in last autumn the meeting of the optical system designer community moved to another great Mediterranean city – Barcelona. The end of November is rather late in the year, but while others see the first snow, temperatures in Barcelona may rise as high as 19°C (66°F). The general claim of the congress is to cover the latest technological advances in optical design and engineering. This is done in four subconferences:

- Illumination Optics III
- Optical Design and Engineering V
- Detectors and Associated Signal Processing V
- Physical Optics II

The list of plenary speakers demonstrates the wide spectrum of topics discussed. It starts with "Solar Cells" from Antonio Luque (Madrid, Spain), and goes on with F.Z. Fang (Tianjin, China) and "Manufacturing of Freeform Optical Components". It will be interesting to see the state of freeform optical design in China. Next on the list is Ulf Leonhard (St. Andrews, UK) with a talk on transformation optics, which relates to the hot topic of metamaterials. He will show how, for example, such transformation devices can make things invisible or create perfect images with a resolution no longer limited by the wave nature of light. Last, but not least, is Rubén Mohedano (Madrid, Spain), who will speak about "Recent Developments in Optics for Solid State Lighting".

More than 150 presentations are expected in total, the program will be accomplished by several networking activities and a poster session. AOT Board member Peter Hartmann and Steffen Reichel, both from Schott AG (Mainz, Germany), will again organize a "SCHOTT User Workshop on the Properties of Optical Glass, Filters, and Special Materials" on Monday 26 November. A two-day industry exhibition is planned for 27th and 28th November. (**http://spie.org/x13206.xml**).

## Frontiers in Optics 2012/LS XXVIII

Rochester, NY, USA, 14–18 October 2012

Frontiers in Optics 2012 is OSA's 96th Annual Meeting and is being held together with Laser Science XXVIII, the annual meeting of the American Physical Society (APS) Division of Laser Science (DLS). The two meetings unite the OSA and APS communities for five days of cutting-edge presentations, stimulating invited speakers and a variety of special events spanning a broad range of topics in physics, biology and chemistry. FiO 2012 also offers a number of Short Courses taught by insightful teachers. Also featured at FiO 2012, is an exhibition presenting leading optics companies.

Last year, attendees could choose from more than 850 technical presentations, on topics as diverse as digital holography and optical microfabrication to optical signal processing and metamaterials. Next year, the FiO will move to Orlando, Florida (6–10 October 2013) (**http://www.frontiersinoptics.com**).

## 113th Annual Meeting of the DGaO (Review)

Eindhoven, The Netherlands, 29 May–2 June 2012

The optical industry is doing well this year and so did the optics community at the annual meeting of the German Society for Applied Optics DGaO. This meeting has a long tradition of almost 90 years, and every now and then, it is also held outside Germany. Eindhoven (NL), as the home of companies like Philips or ASML, is certainly a great place to discuss the recent developments in optical technologies. The organizers from the DGaO collaborated with the Dutch Photonics Cluster Netherlands PCN and their common expectations were well met when many local experts joined the auditorium (Figure 1). Totally, there were some 250 participants, mainly from Germany and the Netherlands, presenting nearly 80 talks and about 50 posters.

 

**Figure 1** Stefan Bäumer, Gerrit Kroesen (local organizers), Mary-Ann Scheurs (City of Eindhoven), Michael Pfeffer (Past President DGaO).

## Main topics: LED and Lithography

The presentation program of this 5-day congress spun from LEDs via optics manufacturing, optics design, lithography to such colorful topics like optics in nature. The opening lecture on trends in LED illumination (Peter Duine, LED Business Architect at Philips Lighting) showed already one of the main topics of this year's conference: how LED will change our life and what electrical and optical characteristics will enable new applications. Even more discussed at the meeting were new trends in lithography. Reinhard Völkel, CEO of SUSS MicroOptics, reviewed the evolutionary development of optical lithography and briefly discussed options for the future. Heiko Feldmann, Principal Scientist at Carl Zeiss SMT, Oberkochen (Germany), sketched the development of the optical systems for lithography, showing how the increasing demands are driving new design principles, including the latest mirror systems for the EUV lithography. Innovations involve such areas as system layout, optical and mechanical design, as well as optical metrology, optics production, and coating technology. A particular highlight related to lithography was certainly the Fraunhofer lecture given by Jos Benshop from ASML.

## Beautiful physics

Opposite to many other physics conferences, the annual meeting of the DGaO always has a session where scientists lean back and think about the natural beauty they find in their field. This is the 'Optics in Nature' session: One presentation by a local team from Eindhoven, led by Gerrit Kroesen, showed a number of colorful gas discharge experiments, while another talk by Peter Vukusic (Exeter, UK) gave us bright insights to the biological examples of color manipulation. He explained how nature has developed not only periodic 2D or 3D structures but also half-wave plates and combinations of periodic and 3D structures to increase certain color effects. A deepened black is achieved with such tricks as well as a perfect white (much brighter than our white paper). Although not entirely directed to the latest technical advances, this session received a full auditorium and a lot of applause.

## Fraunhofer lecture

It became a tradition already to present the prestigious Fraunhofer lecture on the last evening of the conference at the conference banquet. This year, it was given at the DAF Museum in Eindhoven, by Jos Benschop, Senior Vice President Technology of ASML. He gave the audience a tour through the amazing history of lithography. To the surprise of many people involved, Moore's law is still valid, and we see the number of transistors on an integrated chip doubling every 18 months. There are just very few parameters (wavelength, numerical aperture, and k-factor) that can be improved for higher resolution. The speaker showed which tricks are used to overcome the natural resolution limit of about a wavelength. Using the 193-nm light and immersion optics with a numerical aperture of 1.35, state-of-the-art immersion

scanners print 40-nm-wide lines on a 300-mm resist-coated silicon wafer. In the future, EUV technology will enable a resolution below 20 nm. The productivity of these optical lithography scanners has increased recently (as you may learn from some articles in this issue). For 'conventional' lithography, i.e., tools using conventional light sources, structured illumination will enable further progress.

## Summary

After all, it was a great place for learning something new and exchanging views with a bright audience. Networking was well supported with plenty of coffee breaks, an excursion to s'Hertogenbosch (or Den Bosch, as the locals say) and a great festive dinner in the halls of Eindhoven's DAF museum, the local Dutch car manufacturer. During this event, the new president of the society was introduced: Frank Höller (Carl Zeiss AG, Oberkochen) will take over for 2 years from the past president and editor-in-chief of AOT, Michael Pfeffer.

The next DGaO meeting will take place from 21 to 25 May 2013 in Braunschweig, Germany. More information can be found at **www.dgao.de**.

## 8th International Conference on Optics-Photonics Design and Fabrication ODF12 (Review)

St. Petersburg/Lake Ladoga, Russia, 2–5 July 2012

The International Conference of Optics-Photonics Design and Fabrication ODF is a biannual international conference created by Japanese engineers and researchers working in industry. It was started in 1998 and was held for four years in Tokyo. Then it made a "hop" to Nara (ODF'06), a "step" to Taipei, Taiwan (ODF'08), and a "jump" to St. Petersburg, Russia (ODF'12). So this year ODF came to Europe for the first time after years of enthusiastic demand from the Russian Optical Society ROS to hold ODF in St. Petersburg. The conference started in St. Petersburg on the boat "Vissarion Belinsky". The ship left the port of St. Petersburg on July 2nd and took the route to the marvelous Ladoga Lake (Figure 2), visiting Valaam and Mandrogi, and arrived back to St. Petersburg on July 5th. As Kimio Tatsuno (EOS Asia Liaison Officer/ODG/Hitachi Ltd.) put it: "Russian, Japanese and European optical groups together made ODF'12 a great success on a boat sailing on the Lake Ladoga."

The total number of participants was limited to 220 by the size of the boat. Japan had the largest group (67), followed by Taiwan (53) and Russia (52). The total number of contributed papers was 185; here Taiwan led the field with 59 papers ahead of Japan (35) and Russia (28). The Best Paper Award was given to the outstanding optical scientist from America, G.W. Forbes (QED Technologies Inc. USA) for his presentation on "High-precision freeform optics ...the shape of some important things to come". The best poster awards were given to H. Kawano (Mitsubishi Electric Corp./Japan) "Compact and Large-Depth-of-Field Image Scanner for a copier", and R.V. Romashko (Institute of Automation and Control Processes FEB RAS/Russia) "Micromechanical Mass Sensor with Holographic Interferometer".

ODF'12 is an international forum for the engineers and scientists in the field of design and fabrication of optics and optical components. Probably the most discussed trend at this year's conference was freeform


**Figure 2** Participants of the 8th International Conference on Optics-Photonics Design and Fabrication ODF'12 enjoyed the wonderful landscape around Lake Ladoga and the so-called 'White Nights' at this northern area.

 

optics. The list of all topics covered was much longer: lens design, optical theory, fabrication and testing, software, DOE's, micro-optics, nanophotonics, photonic crystals, near-field optics, thin films, waveguide and fiber optics, MEMS, lasers, illumination optics, information optics, optical storage, optical lithography, microscopy, displays, biomedical optics and new technologies for optics and fabrication.

The ODF'14 will be held in Itabashi Tokyo coupled with the CP+, the world's biggest camera show. ODF is welcoming proposals to hold ODF after 2016 from all over the world. More information on ODF'12 is available at **http://odf2012.ru**.

## IODTS'12 – Fourth International Optical Design and Technology Seminar

Immediately after ODF'12, The Fourth International Optical Design and Technology Seminar IODTS took place in St. Petersburg from the 5th to 7th July. IODTS is a small workshop-like series of seminars with in total 56 participants in 2012. The main seminar objectives lie in the promotion of the field of optical design and technology in general as well as high-level education and qualification in particular. Among others, this year's program included presentations of various optical design software packages, a round table "International cooperation in the field of optical instrument making and technology", and a plenary session on ISO Standards for optics manufacturing led by AOT Editor in Chief Michael Pfeffer.

Bringing the conference and the seminar to St. Petersburg, Russia was a success of the ongoing commitment of the National Research University of Information Technologies, Mechanics and Optics (NRU ITMO), in St. Petersurg, Russia, where optics and photonics are priority directions in education and R&D.

## Stuttgart Laser Technology Forum SLT'12 / LASYS (Review)

Stuttgart, 13–14 June 2012

The Stuttgart Laser Technologies Forum, which takes place on a biannual cycle since more than a decade is aimed at knowledge transfer between academic research on industrial laser applications, on the one hand, and the laser manufacturing industry, on the other. Therefore, it is also of mutual benefit that it is colocated with the biannual trade show LASYS.

### Strong growth at LASYS

The third edition of LASYS, the international trade fair for laser material processing, finished with a 34% increase in visitors. Over 5200 visitors came to Stuttgart during the 3-day trade fair to obtain information on novelties and trends in the field of laser material processing. Almost every fourth visitor came from abroad, and a total of 31 countries were represented. The 178 exhibitors at LASYS presented innovations and further developments of machines, processes, and services for laser material processing, including the laser-specific machine subsystems. A total of 28% of the LASYS exhibitors came from abroad, traveling from 17 countries, mainly in Europe, but also from the USA, China, Canada, Belarus, and Turkey.

### Peter Leibinger discussed future trends at SLT

The current trends in laser technology and the best-practice examples for the application of lasers in materials processing as well as the opportunities of technology transfer to the industrial environment are presented at the SLT by well-known experts from the industry and science.

The core topics of the SLT 2012 once more covered process control, high-precision ablating micromachining, and user experience on the application of high-brilliance CW lasers (especially thin-disc and fiber) in processes like cutting and welding.

Eagerly awaited were the presentations from the nearby located market leader TRUMPF group. Peter Leibinger (Vice Chairman of Trumpf and President of the Laser Technology and Electronics Division) discussed the eminent question 'Industry Laser Trends – Have we reached a turning point?'. This related to the state of technology and the trends he can identify. He sees a further reduction of cost per Watt of laser power (although it may have less impact on the system price). Diode lifetimes have reached a level where a further increase is not necessary. Short-pulse lasers have a strong potential, but still, some basic technology is missing. Last but not the least: He expects no big improvements in the efficiency of current laser systems. So indeed, we may have reached a turning point: After the huge improvements in diode cost and lifetimes as well as the rise of fiber and disk lasers in recent years, we will see less progress in the technical parameters in the coming years – unless short-pulse lasers make

a technical leap and conquer entirely new application fields, which would be a turning point in itself.

## Market review at the Laser Market Place

Arnold Mayer is a well-respected expert observing the laser material processing in Europe and the world. After the demission of some of his American colleagues, he is almost the last remaining expert in this field, and accordingly, his 'Laser Market Place' seminar was well attended. In his own presentation, he showed that the laser system market for material processing is doing better than ever before with an annual revenue of about USD 10 billion (EUR 7.2 billion). For 2012, he expected a flat development of the market.

For the time between 1999 and 2011, he calculated a cumulated annual growth rate of 7.3% based on Euro figures and even 9.7% based on US dollars. As a new trend, he recognizes that the laser market approaches the ups and downs of the general machining market, which is a sign for the maturity of industrial laser technology. So in the future, the growth in the laser field will be stronger, superimposed by macroeconomic cycles. Nevertheless, laser stocks made a great 8% average growth within the last 12 years.

Besides the market analysis, there was at least one remarkable technical presentation at Mayer's Laser Market Place. Dirk Petring from Fraunhofer ILT spoke about the comparison of the new and the old market champions: fiber and $CO_2$ lasers. After years of experimental research and extensive simulations to compare and understand cutting with 1 µm and 10 µm radiation, he showed some results and some unique conclusions. It was found that the surface quality of fiber laser cuts becomes worse in thicker materials. He identified multiple reflections of the 1-µm radiation as the reason for turbulences and higher temperatures that occur when strong fiber lasers are used to cut steel of several millimeter thickness. That leaves the fiber laser as the champion for thin metal sheet cutting regarding speed and efficiency, and $CO_2$ may still show advantages in thicker sheet metal cutting.

The next LASYS is announced for 3–5 June 2014. For more information, see **www.lasys-messe.de**.

## International Laser Technology Congress AKL'12

Aachen, Germany, 9–11 May 2012

The AKL'12 set a new record this year, attracting over 600 visitors. The biennial congress has further consolidated its position as the leading forum for applied laser technology for manufacturing applications. International participation also rose further. As always, the program in Aachen was extremely varied, including some 76 presentations that, nonetheless, remained tightly focused on the delegates' varying interests: in addition to the beginner's seminar on Laser Technology and the Technology Business Day for executives and marketing managers, the first day was also host to two EU Innovation Forums and a seminar focused on the usage of ultrashort laser pulses in industry. The EU seminars devoted to 'Laser Additive Manufacturing (LAM) in Aeronautics and Power Generation' (EU joint project MERLIN) and 'Perspectives of Polymer Welding with Lasers' (EU joint project POLYBRIGHT) provided an insight into the current state of development of this compelling laser technology for the user industries.

## Laser Technology Innovation Award honors use of ultrashort-pulse laser in the print industry

On the evening of May 9, the Innovation Award Laser Technology 2012 was presented in the Coronation Hall of Aachen City Hall. The award – backed by prize money of €10 000 – went to a team under the direction of Stephan Brüning (Schepers GmbH & Co KG, Vreden, Germany). They fought off competition from a host of other applications by coming up with a solution for the three-dimensional microstructuring of large surfaces for print and embossing applications using high-power ultrashort-pulse (USP) lasers. In the PIKOFLAT joint project funded by the German Federal Ministry of Education and Research (BMBF), Schepers GmbH & Co KG was joined by cooperating companies and institutes to develop a new scanner technology and ablation processes, which support scan speeds of up to 50 m/s. A fast-rotating cylinder and a high-speed scanner based on an acousto-optic deflector, in combination, allow the use of picosecond laser pulses working at over 10 MHz to deliver high-quality results in micromachining. The Innovation Award Laser Technology is presented biennially by the Arbeitskreis Lasertechnik e.V. and the European Laser Institute ELI as a European research award.

## 'Digital Photonic Production' at the Laser Technology Conference

The Laser Technology Conference on May 10 and 11, 2012 constituted the mainstay of the congress. Three separate

 


**Figure 3** Reinhart Poprawe's presentation outlined how laser technologies can help us tackle global challenges (Source: Fraunhofer Institute for Laser Technology ILT, Aachen).

series of presentations showcased new developments in the fields of beam sources and laser material processing in the micro and macro range.

Dieter Steegmüller (Daimler AG) looked at two trends, in particular, in his opening presentation: greater flexibility in manufacturing and new materials in vehicle manufacturing. The materials covered included high-strength steels, new Al alloys, magnesium, and fiber-reinforced plastics. Reinhart Poprawe focused on the issue of flexibility in his presentation afterwards (Figure 3). Under the heading 'Digital Photonic Production', he outlined a new world of manufacturing in which virtually any complex, high-precision components can be manufactured rapidly and directly from computer-generated specifications, as part of a customized or series production.

The subsequent presentations demonstrated that such applications are already a reality in many places: for instance, with the extended application of LAM processes in the aero engine segment. In such applications, it is clear that additive processes, in particular, offer a high level of flexibility coupled with maximum customization during manufacturing, at no additional cost. Poprawe summed up the advantages of Digital Photonic production in a striking phrase: 'Complexity and individualization for free'.

In the field of beam sources, USP lasers again took center stage, alongside current developments in diode and fiber lasers. Entirely new applications are being opened up thanks to the availability of systems with average output of over 100 W. A new generation of USP lasers with high operating reliability, long service life, and acceptable costs has finally made inroads into industrial manufacturing.

## Laser Technology Live

A particular highlight awaited those delegates that were able to stay in Aachen on the Friday afternoon: no fewer than 79 different technical installations and exhibits presented current research findings and developments in industrial laser technology in the Laser Technology Center of the Fraunhofer ILT. These covered the fields of laser material processing as well as the EUV technology or laser beam sources and optics components. The applications are wide-ranging: alongside mechanical engineering, the lineup includes medical technology and electronics, aeronautical and automotive industry, as well as energy and solar technology.

The high-power short-pulse laser, which defines the high-end segment at output power in excess of 1 kW, attracted a great deal of attention. Project manager Peter Rußbüldt explained the technical details with a look inside the system. In recognition of its outstanding multidisciplinary collaboration across all locations, the Fraunhofer ILT and several cooperation partners from science and industry received the Stifterverband's Science Award 2012 for their work on scaling the output of ultrashort laser pulses. This prize was presented on May 8, 2012 as part of the Fraunhofer annual general assembly in Stuttgart.

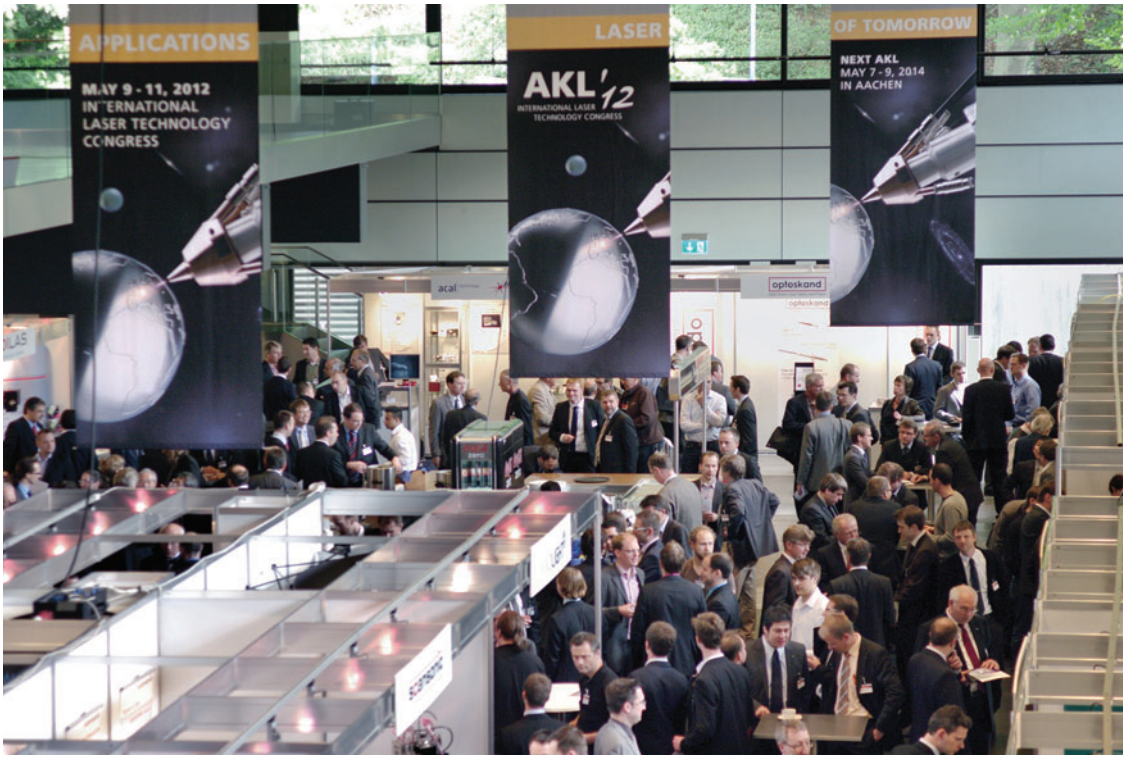


**Figure 4** This year, 45 partners from the field of industrial laser technology took part in the industry exhibition (Source: Fraunhofer Institute for Laser Technology ILT, Aachen).

## Conclusion

This year, too, the International Laser Technology Congress AKL'12 offered a great deal of scope for knowledge sharing and the opportunity to talk directly to different experts, not to mention the many excellent presentations. The next and tenth AKL will be held in Aachen on May 7–9, 2014 (**www.lasercongress.de**).