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LASER World of PHOTONICS 2019

Fraunhofer at the world's leading photonics trade fair

Joseph von Fraunhofer's research into optical phenomena was of groundbreaking importance – and his influence can still be felt today. It is no coincidence that the organization bearing his name continues to conduct research into optics and photonics. Modern applications of light range from quantum communication, through high-precision, robust measurement techniques, to the lasers used in industrial manufacturing. At this year's LASER World of PHOTONICS, twelve Fraunhofer Institutes will be presenting their latest developments and solutions in the field of photonics, spread over two booths (Booth 431 in Hall A2 and Booth 335 in Hall B3).

Photonics has given rise to new developments in many different areas of technology, often serving as a catalyst in innovation-driven sectors of the economy, ranging from spaceflight to IT and industrial manufacturing. Germany is one of the leaders in photonics, and to ensure that this remains so, numerous Fraunhofer Institutes are working on research projects focused on applications in this future-oriented domain.

At LASER World of PHOTONICS, Fraunhofer will be presenting its latest research findings and the latest developments in various relevant fields. Researchers will be on hand in Hall A2 (Booth 431) to demonstrate laser-based solutions and technologies for manufacturing, imaging and optical measuring systems. In Hall B3 (Booth 335), the emphasis will be on optical information and communication systems. Examples of some of the many fascinating exhibits include:

Ultrashort-pulse lasers for maximum precision

Ultrashort-pulse (USP) lasers enable any kind of material to be machined with the highest precision. However, their power output at present is too low for high-throughput applications. To change this, 13 Fraunhofer Institutes have joined forces in the Fraunhofer Cluster of Excellence Advanced Photon Sources CAPS. By pooling their expertise, they aim to increase the output of multikilowatt USP lasers to 10 kW and thus expand these lasers' areas of application. Two members of this cluster, the Fraunhofer Institute for Laser Technology ILT and the Fraunhofer Institute for Applied Optics and Precision Engineering IOF intend to set up application laboratories for research and industrial partners in Aachen und Jena before the end of this year.

Compact quantum cascade lasers for real-time spectroscopy

Fraunhofer Institute for Applied Solid State Physics IAF develops together with Fraunhofer Institute for Photonic Microsystems IPMS extremely compact and robust quantum

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cascade lasers for various spectroscopic applications in the mid-infrared. The researchers present a measurement system that enables remote and non-destructive real-time identification of a wide range of chemical and pharmaceutical substances and is thus suitable for quality monitoring in the food, chemical and pharmaceutical industries as well as for process control in general. The compact design of the laser modules also enables the development of mobile to hand-held measuring systems for on-site detection.

Laser processes for e-mobility

Electric mobility would be unthinkable without lasers. That's one of the messages of LASER World of PHOTONICS 2019. Fraunhofer ILT's Laser-Based Tape-Automated Bonding (LaserTAB) is a rapid and precise processing technique based on laser micro-welding that enables battery cells and power electronics circuits to be joined reliably. It effectively combines optics, joining technology and process monitoring in a robotic industrial process. The "eace05" electric racecar of the Ecurie Aix – Formula Student Team, RWTH Aachen, will be on show to demonstrate laser-welded batteries as well as laser-cut CFRP components.

Optical Quantum Technologies

The Fraunhofer IOF is a pioneer in applied research on photonic quantum technologies. For the first time, developments in the field of quantum imaging will be presented at this year's LASER World of PHOTONICS. It is a quantum photonically based imaging system. By using high-power sources of entangled photons, such as those developed at the Fraunhofer IOF, future imaging systems based on quantum technologies can become even more compact, e.g. for applications in biology and medical technology.

MEMS scanner for 3D vision

Robots must be equipped with sensors and software that allow them to see in three dimensions, so that they can orient themselves with respect to their surrounding environment and locate objects precisely. For more than ten years, a team of researchers at Fraunhofer IPMS in Dresden has been developing and building microscanner mirrors, also known as MEMS scanners, with the aim of enabling robots to "see" objects around them and perform tasks requiring a wide field of vision.

Frequency comb spectroscopy for trace gas measurement

The Fraunhofer Institute for Physical Measurement Techniques IPM offers optical and spectroscopic measurement solutions for applications ranging from laboratory research to heavy-duty industrial environments. One of its new products in 2019 is a frequency comb spectrometer for trace gas measurement in the mid-infrared region. It has a particularly wide spectral tuning range, thanks not least to Fraunhofer IPM's many years of experience in non-linear frequency conversion.

Precision optics on curved surfaces

When conventional PVD processes are used to coat curved optical components, this may result in an undesirable layer thickness gradient. Researchers at the Fraunhofer Institute for Surface Engineering and Thin Films IST have developed a coating process us-

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ing the MOCCA⁺ Modular Coating Control Application which compensates for this effect by precisely controlling the deposition of gradient layers. In this way, the desired filter performance can be achieved over the entire surface of the lens. The institute's exhibit features a bandpass filter/lens array with a central wavelength of 670 nm and a very broad blocking range of 200-1100 nm in the rest of the spectral region.

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remoweld[®]FLEX makes nonweldable materials weldable

Fraunhofer engineers in Dresden have developed a new laser welding process based on a high-speed oscillating laser beam. This technology, known as remoweld[®]FLEX, is particularly suitable for qualitatively demanding processes – especially for components requiring a media-tight seal to prevent the intrusion of water and other undesirable contaminants. These include housings for electrical and electronic components, heat exchangers and air conditioners, which are often made of die-cast aluminum, a material which until now has been considered nonweldable. The Fraunhofer Institute for Material and Beam Technology IWS collaborated with the Ravensburg-based company Maschinenfabrik Arnold on this development project.

Earlier diagnosis, better therapeutic outcome

The Fraunhofer project hub Microelectronic and Optical Systems for Biomedicine MEOS is taking part in LASER for the first time this year. It develops photonic systems to support biomedical research with a view to diagnosing diseases such as cancer at an earlier stage and improving their therapeutic outcome. The project hub's exhibit at LASER features surface light modulators designed as an array of micromirrors, which can be combined to produce modules for high-resolution optical microscopy and optogenetics applications. These devices control the incident light by means of spatial, angular and linear time filters, and also help to reduce phototoxicity during the imaging process.

Compact laser sources for quantum applications

Fraunhofer CAP is the first Fraunhofer centre located in the UK. Founded in 2012 it celebrates its 7th birthday as Fraunhofer-Gesellschaft celebrates its 70th. Located in Glasgow it specialises in applied photonics. Recently Fraunhofer CAP has been a key delivery partner in the UK's Quantum Technology programme with a wide portfolio of projects with commercial partners. Projects include gravity and magnetic field sensing and inertial navigation. Fraunhofer CAP will exhibit compact laser sources for quantum applications which have been developed with commercial partners and launched as products.

Visitors to LASER World of PHOTONICS in Munich from June 24 to 27, 2019, the world's leading trade fair for photonics components, systems and applications, will be able to see these and other pioneering technologies at the joint Fraunhofer exhibits (Booth 431 in Hall A2 and Booth 335 in Hall B3).