RESEARCH CAMPUS DPP

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RESEARCH CAMPUS DIGITAL PHOTONIC PRODUCTION DPP

Goals and tasks

The Research Campus »Digital Photonic Production DPP« in Aachen is a location where scientists can explore new methods and basic physical effects in order to use light as a tool in the production of the future. Thanks to the BMBF funded Research Campus DPP, RWTH Aachen University, the Fraunhofer-Gesellschaft and industry can establish a new form of long-term and systematic cooperation that aims to concentrate the various resources under one roof for joint, complementary application-oriented basic research. This is made possible by a new building on the RWTH Aachen Campus: the Industry Building DPP. Here the partners from business and science can research together on about 7,000 square meters of office and laboratory space under one roof as part of the Research Campus DPP.

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Road mapping process

The collaboration of the two Fraunhofer Institutes ILT and IPT and the around 20 industrial companies is defined in jointly agreed technology roadmaps. Alongside the technology roadmaps, the partners are exploring basic aspects of light generation (e.g. modeling of ultra-short pulse resonators), new possibilities of light guiding and shaping (e.g. modeling of free-form optics) and physical models for the interaction of light, material and functionality (e.g. modeling of load-optimized additively manufactured structures).

Joint working groups

The cooperation at the Research Campus DPP is organized along the technology roadmaps in joint working groups with scientists from the scientific community and the industry. The following five working groups have been established:

- DPP Direct
- DPP Femto
- DPP Nano
- DPP MaGeoOptics
- DPP Digital Photonic Process Chain

DPP Direct

The additive manufacturing process Laser Powder Bed Fusion (LPBF) allows the direct, tool-free production of functional components with serial-identical properties. In addition to the high resource efficiency, the tool-less production of complex components is particularly noteworthy. They can be produced quickly and comparatively inexpensively in small numbers. Likewise, functionally and weight-optimized components for new products with improved properties can be built cost-effectively. The LPBF process is increasingly used in industries such as dental technology, toolmaking, power engineering, automotive engineering and aircraft construction.

DPP Femto

With the relatively new ultra-short pulse lasers (UKP lasers), new functionalities can be created on components made out of different materials. However, the fundamental connections between the interaction between UKP laser light and modern functional materials of the digital world have not yet been sufficiently researched. The partners in the network project DPP Femto aim to analyze these complex relationships in detail and, thus, open up new horizons for this laser technology in the processing of electronic components, such as in display making or the production of modern LEDs.

DPP Nano

In order to carry out localized, timed, precisely applied heat treatment, researchers have been developing and testing new laser beam sources (such as, for example, VCEL lasers), optical systems and algorithms. Their aim is to produce tailor-made, material-matched light distributions. These new applications are being developed in the industry (e.g. by the functionalization of surfaces based on nanoparticulate materials), which increases the productivity of heat treatment processes (e.g. laser hardening) as well as the application spectrum (e.g. the production of complex components from composites).

DPP MaGeoOptics

The aim of the research project »MaGeoOptics« is to significantly increase the performance of current beam guidance systems by using high-quality optics, novel materials and more complex geometries. For this purpose, research is designing and qualifying new pressing processes for quartz glass, developing software and processes with innovative machining kinematics for diamond optics and using suitable metrological methods of non-contact optical inspection. As a result, complex geometries – for example, array structures with aspherical individual geometries – can be produced in quartz glass cost effectively.

DPP Digital Photonic Process Chain

The high energy density in the laser focus can be used to either selectively ablate or melt material. Thus, the smallest structures can be inserted into the surface of components for technical functions or design purposes. Modeling the sophisticated structures is very complex, thus costly, with common CAD/CAM systems. Therefore, a digital infrastructure has been created to utilize procedurally described structures for photonic manufacturing processes. The results are implemented in CAx libraries for path calculation and then integrated into conventional CAM software products.

Start of the second funding phase in 2020

The development of the Research Campus DPP has been supported by the Federal Ministry of Education and Research since 2014 within the funding initiative »Research Campus - Public-Private Partnership for Innovation«. At the end of 2019, the Research Campus DPP was evaluated by an independent jury and recommended for a second five-year funding phase. From spring 2020, the research campus will enter the second funding phase with 31 partners and continue using its advanced and agile management system.

1 Meeting space in the light-flooded atrium of the Industry Building DPP.
2 DPP Nano: Selective preheating by means of VCSEL in Laser Powder Bed Fusion (LPBF).