PRESS RELEASE

Stifterverband Prize for Multi-beam Laser Processing

The ultra-short pulse laser is seeing ever wider acceptance among industrial users as a tool for precision manufacturing. In particular, these advances are due to new developments or technological progress in system technology, which increase productivity considerably. Increasing productivity significantly was also the goal of a team from industry and research, which was awarded the Science Prize of the Stifterverband for Collaborative Research at the annual conference of the Fraunhofer-Gesellschaft on October 9. The team has developed a technology in which a laser beam is split into up to 16 partial beams. That means there are 16 tools controlled in parallel and individually to produce functional surfaces.

Today, laser material processing is driven not only by economic, but also environmental aspects. For example, fine surface structures are often molded using an embossing tool. Manufacturing these embossing tools with conventional wet chemical etching processes is harmful to the environment How to increase productivity and replace these wet etching processes by laser direct ablation has kept experts busy for a long time. Their vision was to make production technology sustainable and environmentally friendly.

Currently, lasers can easily be used to achieve the necessary precision in processing: down to a few micrometers. In contrast to the etching process, however, the laser processes the structures sequentially; thus, a single laser is yet too slow for large areas. Using several laser systems in parallel would be feasible, but still too expensive.

Faced with this unsolved problem of "producing fine structures with high productivity," the mechanical engineers Dr. Stephan Brüning from Schepers GmbH & Co. KG and Dr. Gerald Jenke from Matthews International GmbH joined forces with laser researchers from the Fraunhofer Institute for Laser Technology a few years ago. Together with Dr. Keming Du from EdgeWave GmbH Innovative Laser Solutions and Dr. Manfred Jarczynski from LIMO GmbH, they applied for funding from the Federal Ministry of Education and Research (BMBF) within the framework of the funding initiative "The Basis of Photonics: Functional Surfaces and Coatings."

Sustainable development along the entire value chain

Dr. Arnold Gillner, who worked with Martin Reininghaus and Dr. Johannes Finger from the Fraunhofer Institute for Laser Technology ILT on the MultiSurf joint project, summarizes the solution approach as follows: "Anyone who wants to successfully

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develop such complex technologies really should look at the entire value chain. This requires a wide variety of skills, which means intensive teamwork."

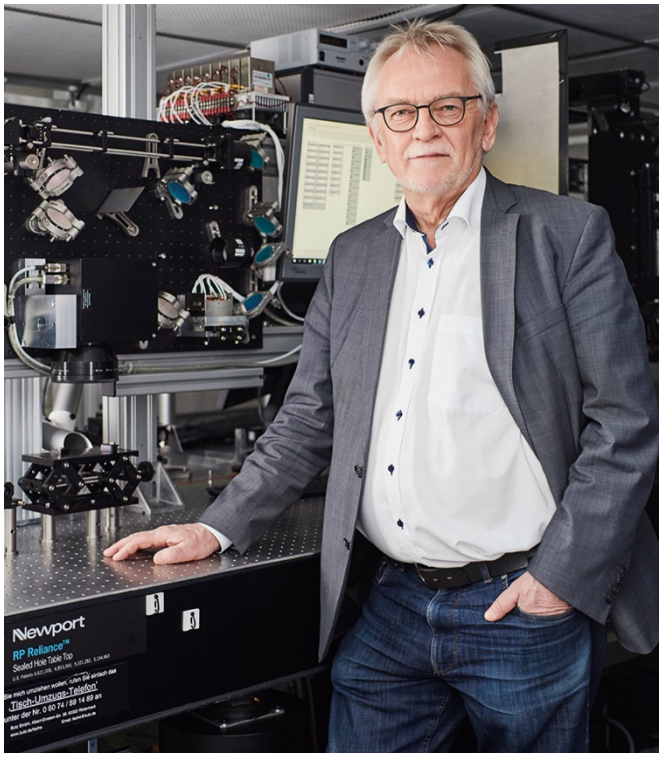
Accordingly, a team across company, technical and institute boundaries developed the solution for efficient surface structuring with the laser. The technical core is a new ultra-short pulse laser with 500 W average power. A special optic splits the incoming laser radiation into up to 16 partial beams – in the meantime, the technology has even been expanded to 64 beams. They are individually controlled with special crystals. The beam matrix is guided across the surfaces to be structured, whereby the beams are quickly switched on and off as required. The exact parameters for optimum material ablation were simulated and matched with process knowledge that the experts at Fraunhofer ILT have acquired over many years.

No upper limit has been set

The individual components are integrated into a new machine system based on the Schepers Digilas machine. Since it combines processing quality and speed, this machine surpasses all current systems for structuring embossing cylinders. It is probably the first machine in the world to enable complex ultrashort pulsed laser microstructuring of metals at ablation rates of up to 100 mm³/min.

Of course, this technology can be applied in a much wider range: tools for other roll-to-roll processes are under discussion, as are special work steps in battery and hydrogen technology. For the ablation of periodic structures, Fraunhofer ILT has also developed systems with more than 300 parallel beams, but these cannot be controlled individually. All of this is part of a new technology generation for the production of functional surfaces. When the power of the laser systems is scaled further, even larger surfaces could be processed economically in the future. For example, the wind resistance of wind turbines or airplane wings could be reduced with a suitable surface processing.

The prize ceremony took place on the evening of October 9 in Berlin. Dr. Arnold Gillner from the Fraunhofer Institute for Laser Technology accepted the prize – endowed with €50,000 – on behalf of the partners in the alliance. The other partners took part the award ceremony at a hybrid event via the Internet.



Picture 1:
Dr. Arnold Gillner accepted the science prize of the Stifterverband for Collaborative Research on behalf of the partners in the joint project MulitSurf.
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Picture 2:
Large-format (1 m x 1.5 m) embossing plate produced with the new multi-beam engraving system.
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