PRESS RELEASE

Fraunhofer ILT demonstrates solid, future-oriented portfolio

Fraunhofer institutes are links between research and industrial application. The Fraunhofer Institute for Laser Technology ILT will be demonstrating how impressively these links work at formnext from November 7 to 10, 2023 in Frankfurt am Main. Each exhibit tells a success story from completely different industries and applications, with completely different materials and processes.

For more than 35 years, Fraunhofer ILT has been driving additive manufacturing (AM) forward – especially of metallic components, for example with laser powder bed fusion (LPBF) or laser material deposition (LMD). In addition to looking at sustainability, the institute's broad-based research focuses on optimizing economic efficiency. To this end, the laser experts view the process chains from beginning to end: starting with component design to process control, materials and systems engineering, right through to finishing. In close cooperation with leading companies, the Aachen institute is continuously involved in exciting developments, some of which it will be presenting at the joint Fraunhofer booth in Hall 11, booth D31 at formnext in Frankfurt, Germany.

New developments around EHLA: Extreme high-speed laser material deposition

The new Simultaneous Machining and Coating (SMaC) combination process, for example, merges the EHLA coating process with a simultaneous subtractive finishing step, thereby increasing productivity enormously. In addition to the economic advantages, SMaC also offers technological benefits compared with conventional process chains.

The process heat generated in the coating process softens the material and, thus, makes machining easier. This way, corrosion and wear protection coatings as well as functional surfaces can be manufactured more quickly, causing less wear on the tools. The SMaC technology offers considerable advantages, particularly when high-strength coating materials are applied, which are otherwise difficult to machine.

The EHLA process has been primarily used for wear and corrosion protection applications of rotationally symmetric components. In recent years, in collaboration with various machine builders and end users, there has been further development of

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equipment technology and process control for additive manufacturing, referred to as EHLA 3D.

"The technology is based on tripod parallel kinematics, which allows us to move either the component platform or the machining head very quickly," explains Min-Uh Ko, Group Manager Additive Manufacturing and Repair LMD. Thin-walled aluminum components will serve as an example exhibit at formnext 2023.

"The high relative speeds required can either be achieved by highly dynamic movement of the component platform or the machining head," explains Min-Uh Ko, Group Manager Additive Manufacturing and Repair LMD. At formnext 2023, thin-walled aluminum components resulting from a development collaboration with Ponticon GmbH will serve as an example exhibit.

"H2GO – National Fuel Cell Production Action Plan" bundles the activities of 19 Fraunhofer institutes and aims to reduce CO_2 emissions from road-based heavy-duty transport vehicles. The consortium intends to promote the industrial scaling of fuel cell production in Germany.

Here, Fraunhofer ILT is involved in improving forming tools for the production of bipolar plates. "For the H2GO project, we are developing a physical and digital process chain for coating and repairing forming tools using the EHLA process," explains Fraunhofer ILT project manager Dora Maischner.

The AM experts will present the current research results using a special exhibit: a forming tool coated with EHLA and then finished by laser material ablation. "Our goal is to design simple coating and repair processes for other industrial applications and fields, processes that save time and costs in toolmaking," says Maischner.

AI-based process design for laser material deposition

The success and efficiency of component manufacturing by laser metal deposition (LMD) is strongly dependent on the geometry of the components, as it affects the temperature development in the process. Constant process parameters and thus the constant energy input leads to deviations in the thickness of the deposited layers because the melt pool volume also changes with the temperature. Particularly in the case of complex geometrical shapes, these variations have so far required time-consuming process development.

Max Gero Zimmermann of Fraunhofer ILT is, therefore, training an AI-model to learn the relationships between laser power, geometry as well as other influencing factors dependent on the component and the size of the melt pool surface. "First, we train the

AI-model with data from an LMD process with constant process parameters while building a geometrical shape," Zimmermann said. Eventually, the model should be able to predict the required laser power to ensure a stable process without us having to perform extensive experiments, for example, when the geometry of a component changes.

"The effort required for process development in LMD can be significantly reduced by using the AI-model," Zimmermann adds. The model will also be extended in the future to predict other process parameters, such as feed rate.

Additive manufacturing for the aerospace industry

Thanks to continuous improvements in recent years, additive manufacturing has become a key technology in the aerospace industry for the production of lightweight components and structures. Functional components can be manufactured cost-effectively with complex geometries and defined aerodynamic properties within a very short time.

In addition, 3D printing allows prototypes to be created, tested and optimized more quickly, thus accelerating the rate of innovation. This, in turn, shortens the time from concept to mission. "Especially in the fast-growing market of commercial space applications, the cost-effective production of prototypes and small series plays a crucial role," explains Simon Vervoort, Group Leader Application Development at Fraunhofer ILT. "The customer- and application-specific requirements for aerospace parts are a perfect match for what we can produce with additive manufacturing."

Using various exhibits Fraunhofer researchers will be demonstrating how additive manufacturing can be used in aerospace. These include space components manufactured with LPBF in cooperation with Space Team Aachen – among them a weight-optimized pressure tank used for transpiration cooling of re-entry bodies in the TRACE (TRAnspiration Cooling Experiment) project. Another demonstrator is a gimbal for thrust vector control of the ALYA experimental rocket.

Visit us at formnext 2023, from November 7 to 10 in Frankfurt am Main, at the joint Fraunhofer booth in Hall 11, booth D31.

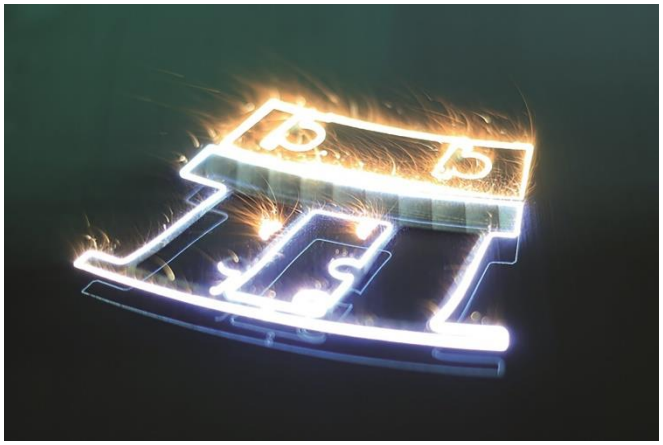

Image 1:
At the joint Fraunhofer booth at formnext, the world's leading trade fair for additive manufacturing and industrial 3D printing, the Fraunhofer ILT will be showing several exhibits demonstrating its range of services.
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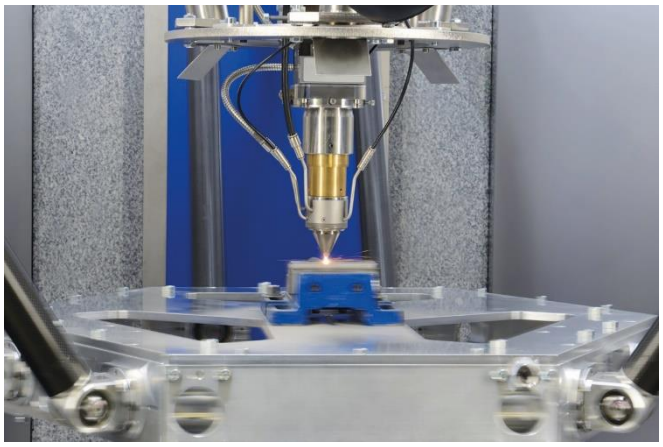

Image 2:
The tripod kinematics in action: stationary powder feed nozzle and moving build platform to perform fast and precise feed movements.
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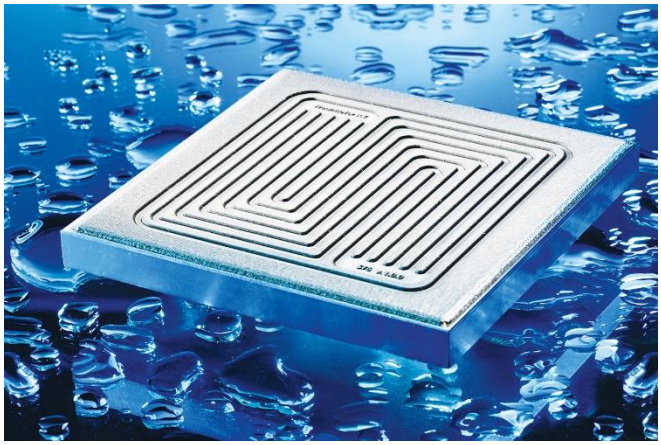

Image 3:
The forming tool coated with EHLA saves considerable time and costs compared to conventional tool making. Tobias Keller from the Surface Technology and Ablation Department at Fraunhofer ILT finished it using laser material ablation.
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Image 4:
SMaC combines the EHLA coating process with a simultaneous subtractive finishing step, thereby significantly increasing productivity. The process heat generated in the coating process makes machining significantly easier.
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Image 5:
Continuous improvements have made additive manufacturing a key technology in the aerospace industry. It allows prototypes to be created, tested and optimized faster, thereby accelerating the rate of innovation.
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