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FRAUNHOFER INSTITUTE FOR LASER TECHNOLOGY ILT

PROCESS DEVELOPMENT FOR LASER POWDER BED FUSION

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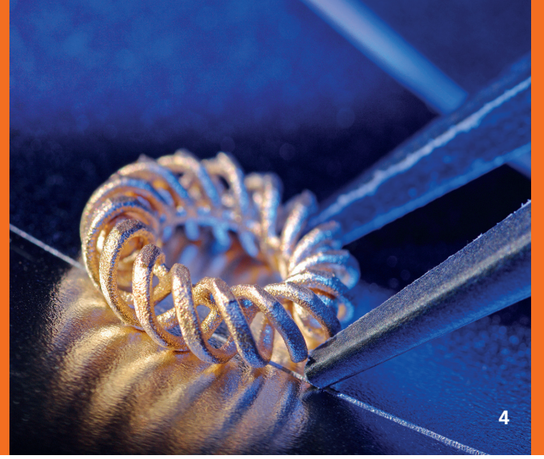
Fraunhofer Institute for Laser Technology ILT

The Fraunhofer Institute for Laser Technology ILT is one of the most important development and contract research institutes in laser development and application worldwide. Its activities encompass a wide range of areas such as developing new laser beam sources and components, laser-based metrology, testing technology and industrial laser processes. This includes laser cutting, ablation, drilling, welding and soldering as well as surface treatment, micro processing and additive manufacturing. Furthermore, Fraunhofer ILT develops photonic components and beam sources for quantum technology.

Overall, Fraunhofer ILT is active in the fields of laser plant technology, digitalization, process monitoring and control, simulation and modeling, AI in laser technology and in the entire system technology. We offer feasibility studies, process qualification and laser integration in customized manufacturing lines. The institute focuses on research and development for industrial and societal challenges in the areas of health, safety, communication, production, mobility, energy and environment. Fraunhofer ILT is integrated into the Fraunhofer-Gesellschaft.

Subject to alterations in specifications and other technical information. 07/2019.



PROCESS DEVELOPMENT FOR LASER POWDER BED FUSION

The Fraunhofer Institute for Laser Technology ILT has been working on the development of the additive manufacturing process Laser Powder Bed Fusion (LPBF) since the mid-1990s and has continued to develop the entire LPBF process chain ever since. The institute's overall goal is to qualify the process for use in industrial production and to integrate it into existing production processes. The experts at Fraunhofer ILT work together with customers from the industry and research on an interdisciplinary basis.

The LPBF process

Since it builds a part layer-by-layer directly from CAD data, LPBF can produce highly complex components from metallic materials without using shaping tools, components that cannot be produced using conventional manufacturing processes such as casting or machining. This means that previous production-related restrictions no longer apply and new components with innovative functionalities can be manufactured. Although the LPBF process is often simplistically referred to as »metallic 3D printing«, in reality it is subject to the influence of many process parameters and disturbance variables. The desired requirements of the user can only be met when these process parameters are selectively adjusted while, at the same time, disturbance variables are kept under control. This applies in particular whenever process limits are expanded. The experts at Fraunhofer ILT support you in optimizing the LPBF process specifically for your application and, if necessary, in developing new strategies to solve your individual tasks.

Tailored LPBF – Tailored for your application

Since manufacturing with LPBF typically requires a compromise between component quality and productivity, Fraunhofer ILT develops innovative machining strategies that eliminate the need for such compromises. Thanks to an energy input adjusted in terms of time and location, process control can be adapted to the component to be produced and the user's requirements, thus enabling machining with high precision and high speed. System technology and software allow each parameter to be selectively adapted down to the level of individual melt tracks. This ensures full control of the LPBF process.

µ-PBF – Highest precision

When the highest precision is required in terms of resolution and surface quality, we offer our customers the fitting solution: the µ-PBF process. For this process, we use special optics and modified system technology to extend the resolution limits to generate the finest structures in the µm range. This way, thanks to µ-PBF, highly complex components down to the size of a pinhead can be produced.

Unlimited variety – Materials

For many users, the supposedly limited selection of materials appears to be an obstacle to using the LPBF process. However, the possibilities are manifold: With partners from industry and research, we have successfully met the challenge of processing demanding materials such as superalloys susceptible to cracking, highly reactive magnesium alloys, highly reflective copper alloys or thermosensitive plastic composites – all with LPBF – and the range is constantly being expanded.

Your application – Our mission

Beyond current research work, many interesting challenges and innovative projects arise only in the interdisciplinary tandem between you as a user and us as a leading research institution.

Get in touch with us and let us jointly develop innovative solutions in order to make optimum use of the LPBF process for your application. Join us in shaping the future of additive manufacturing!

Equipment

In addition to our many years of experience and comprehensive know-how in LPBF, you can also benefit from the extensive equipment at Fraunhofer ILT. Available are more than ten commercial systems from renowned manufacturers and various highly flexible LPBF laboratory systems for metal and plastics processing.

Thanks to their open hardware and software architecture, our systems can be flexibly adapted to your requirements. The technical specifications include the following, among other things:

- Different beam sources (wavelengths, intensity distributions, beam profiles, multi-kW powers)
- Different powder application systems (e.g. top loader, bottom loader, vibration-supported powder application, different application tools)
- Flexible inert gas supply systems
- Preheating of building platforms up to 1500 °C using different heating devices
- Reduced building space for processing small quantities of powder (e.g. precious metals)
- Multi-laser systems (e.g. multi-scanner systems, systems with interchangeable optics)
- Process monitoring systems (e.g. pyrometry, thermography)

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1 Demonstrator with flexible hinges manufactured using µ-PBF.
2 Induction coil of copper alloy.
3 Thermographic image of a LPBF process.
4 Gold alloy jewel.
5 Resorbable, patient-specific implants made of a polylactide-ceramic composite.