Fraunhofer ILT – Short Profile

The Fraunhofer Institute for Laser Technology ILT is worldwide one of the most important development and contract research institutes of its specific field. The activities cover a wide range of areas such as the development of new laser beam sources and components, precise laser based metrology, testing technology and industrial laser processes. This includes laser cutting, caving, drilling, welding and soldering as well as surface treatment, micro processing and rapid manufacturing.

Furthermore, the Fraunhofer ILT is engaged in laser plant technology, process control, modeling as well as in the entire system technology. We offer feasibility studies, process qualification and laser integration in customer specific manufacturing lines. The Fraunhofer ILT is part of the Fraunhofer-Gesellschaft.
PROCESS DEVELOPMENT FOR SELECTIVE LASER MELTING

Since the mid-nineties, Fraunhofer ILT has been developing the Selective Laser Melting process (SLM). Moreover, it has been consistently advancing the entire SLM process chain in order to qualify the process for use in industrial production and to integrate it in existing production environments. To accomplish this, the experts at the Fraunhofer Institute for Laser Technology ILT are working across disciplines together with customers from industry and research.

The SLM Process

Thanks to SLM, highly complex components can be produced layer by layer directly out of metal production materials from CAD data without the need of shaping tools. Indeed, many such parts cannot be produced by conventional manufacturing techniques such as casting or machining. With SLM, however, completely new components with innovative functionalities can be manufactured in the future, as existing production-related restrictions are eliminated.

So that this process can be used in a wide range of industrial production applications, the component quality, productivity, process robustness and material variety, among other things, all need to be continuously improved. At Fraunhofer ILT, we can help you to optimize SLM processes for your application, and, in so doing, constantly push the process envelope.

Component Quality

To ensure continuous improvement of surface quality and detail resolution, we are developing new process strategies such as exposure to modulated laser power developed to control melt-pool expansion. To prevent cracks from forming in difficult-to-weld materials (e.g. heat-treated steels) and to reduce tensions and distortions in general, manufacturers generally use exposure strategies and temperature guides customized to the material. In addition to experimental investigations, our experts are developing models to simulate the SLM process to enhance the understanding of processes considerably.

Productivity

To increase productivity of the SLM process, Fraunhofer ILT is developing adapted process strategies in order to efficiently use increased laser power and multiple laser sources used in parallel. It is also evaluating them in terms of the build-up rate achievable and the resulting component properties.

Robustness

To improve the robustness and reproducibility of the SLM, we are systematically identifying how the powder material, plant components (e.g. of the optical system, the powder application and the inert gas guide) and the exposure strategy influence process stability and component quality. In addition, on-line process monitoring methods for SLM are being developed for quality assurance.

Range of Materials

The range of materials that can be processed is continuously being expanded for both customized materials as well as for material groups across many applications and sectors, such as copper or magnesium alloys. This expansion includes adjusting process parameters and plant engineering, including the laser beam source to the needs of the material. In addition, we can determine the appropriate heat treatment and ascertain the mechanical properties attainable.

Range of Services

Fraunhofer ILT began developing the SLM process in the mid-90s and has since then continued to refine it in close cooperation with leading industrial companies and research institutes, while taking the entire process chain into account. Thanks to our know-how and years of experience, our experts can individually support you based on your needs, from an initial idea through feasibility studies, process and system development all the way to the implementation of the results in your production environment. You can not only fall back upon our extensive plant equipment, consisting of different commercial systems and highly flexible laboratory facilities, but also upon our expertise in the field of optics and laser beam source development. Through our close cooperation with other Fraunhofer Institutes, the FH Aachen University of Applied Sciences, the University Hospital RWTH Aachen and RWTH Aachen University, you also benefit from the combined expertise of Aachen’s location in the field of additive manufacturing.

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1 SLM components made from a copper alloy.
2 Micro components with high detail resolution and surface quality made by means of SLM process control with modulated energy input.
3 Modeling of the SLM process.
4 Monolithically manufactured component groups with movable parts.
5 Process control during SLM by means of temperature maps.