LASER BEAM CUTTING

Fraunhofer ILT - Short Profile

With about 330 employees and more than 11,000 m² of usable floorspace 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 with more than 80 research units, 18,000 employees and an annual research budget of over 1.6 billion euros.
Simulation and Analysis of Cutting Techniques

The CALCut simulation software reveals the dependencies of the cutting results on the process parameters and makes them predictable. In addition to variables that can also be determined experimentally, such as the maximum cutting speed and the kerf width, the simulation also provides development engineers with variables which are difficult or impossible to attain. These include the melt film thickness, the absorbed laser beam power and the vaporization rate. For instance, it was simulation that made it possible to explain for the first time the positive, speed-increasing and the negative, destabilizing effects of multiple reflection when cutting with 1 µm wavelength lasers.

Monitoring and Control

Process monitoring and control increases the reliability and productivity of laser cutting systems and makes an important contribution to quality assurance. Fraunhofer ILT develops algorithms and systems for self-optimizing laser cutting machines. In the future these will make manual setting up and cutting parameter determination unnecessary as they will adapt the process parameters automatically to the requirements of the cutting job and the actual status of the process.

Facilities

- CO₂ lasers up to 20 kW
- Disk lasers up to 10 kW
- Fiber lasers up to 4 kW
- Lamp- and diode-pumped solid-state lasers up to 8 kW
- Short- and ultrashort-pulse lasers up to 1 kW mean output
- CO₂ flatbed laser cutting unit, Trumpf 6 kW TruLaser 5030
- Trumpf Lasercell TLC 105 with TLF2601t CO₂ laser
- High-performance scanners up to 8 kW
- 2D high-speed system, 4 g, 300 m/min
- Reis RLP16 laser gantry robot
- 6-axis robot, Kuka and Reis
- Various multi-axis processing systems
- Various cutting heads from leading manufacturers and own developments with lenses and mirror optics
- Laserfact combi-heads for welding and cutting
- High-power beam diagnosis (Microspot Monitor, Focus Monitor)
- High-speed cameras up to 100 kHz image rate
- Schlieren diagnosis unit
- Roughness and contour measurement equipment
- Scanning electron microscope with EDX
- White light interferometer
- UV-IR spectrometer

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1 Laser cutting of car body parts made of high-strength steel.
2 Cutting profile parts with a combi-head.
3 Diagnosing the thermal loading of a cutting optic.
4 Simulation of a cutting front with laser caustic, melt film geometry and temperature distribution.
5 Cut edges in stainless steel, thickness 12 mm.