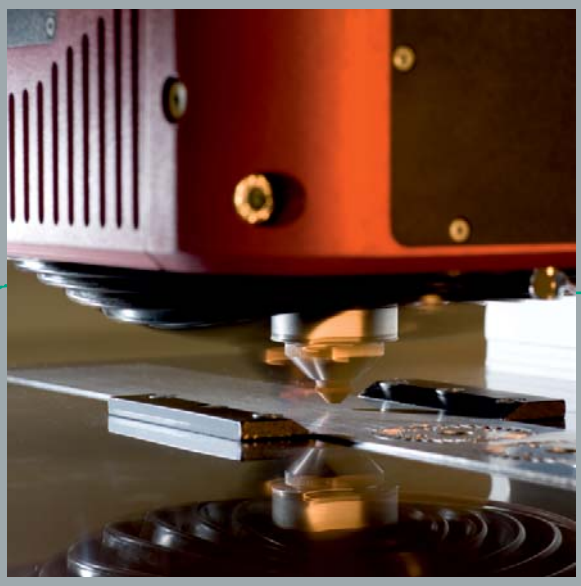
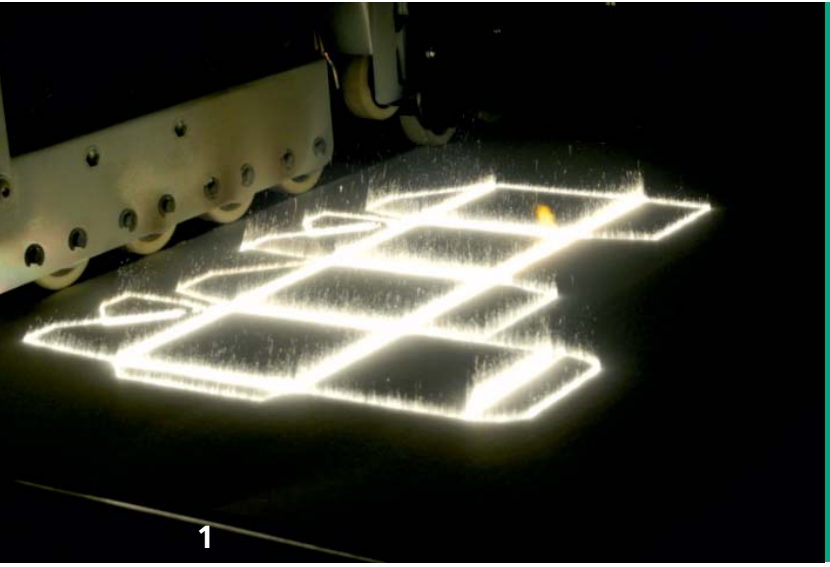
Fraunhofer
IWS

FRAUNHOFER INSTITUTE FOR MATERIAL AND BEAM TECHNOLOGY IWS

BUSINESS UNIT
LASER ABLATION AND CUTTING

DRESDEN





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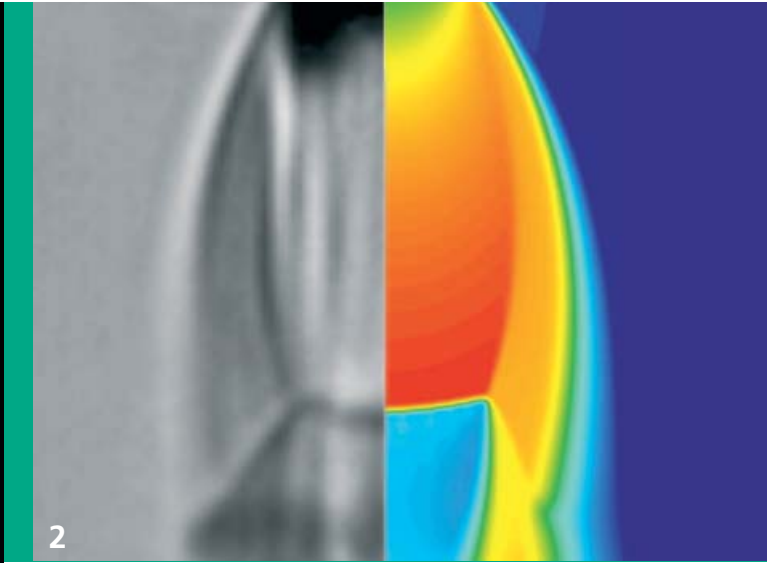

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LASER AS TOOL FOR CUTTING TASKS

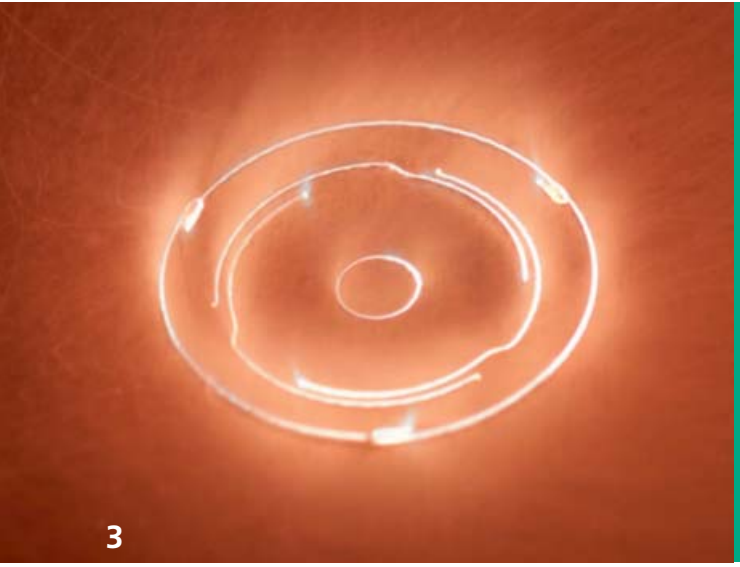
The scientists of the Fraunhofer IWS research and develop laser-based procedures and systems for cutting and ablation processes. Current topics include cutting technologies with cw lasers of high brilliance, the development of remote procedures and system components for cutting, ablation, surface treatment and joining. Process modelling enables efficient, simulation-assisted developments of customized laser processes. The unique feature of our business unit is the laser-based property optimization of soft magnetic materials.

Scientific basis

- comprehensive know-how of process and system technology
- development of process-specific system technology
- software development
- process design and analysis

Trend

In the field of laser cutting our development priorities include high speed cutting technology with brilliant high-power lasers, the enhancement of cutting edge quality and the optimization of cycle times. The remote technologies focus on the highest processing speeds during cutting and other laser processes. Latest trends concentrate on the control and monitoring of cutting and ablation processes and on the development of flexible laser shaping modules.



OUR COMPETENCIES

Laser beam cutting

With respect to laser beam cutting processes, apart from comprehensive process understanding, our research emphasizes the process development in the field of laser fusion cutting and laser flame cutting. Our research work concentrates, for example, on the improvement of the cutting quality during cutting processes with solid state lasers as well as on the optimization of the laser cutting of electrical steel sheets while still maintaining the magnetic properties. Another main focus is the qualification of novel cutting procedures such as laser remote cutting for manufacturing integration. For all these tasks the Fraunhofer IWS can employ numerous lasers of diversified wavelengths, performance and beam qualities combined with highly dynamic 2D and 3D cutting units.

High speed laser processing

Our research addresses the development of process and system technologies for high-speed applications. Profound process understanding is the major basis for the successful implementation of our technologies into industrial applications. The procedures and solutions are characterized by the highest process speeds. The spectrum includes the development of remote processes for cutting, ablation, surface treatment, and joining of metals and non-metals. It also covers the design, set-up and qualification of highly dynamic processing systems.

Process design and analysis

Research foci are the theoretical design and optimization of laser-based or laser-assisted technologies in accordance with fundamental thermodynamic relationships and corresponding equations of state. The thermal efficiency achievable through these processes will be qualified in comparison to competing techniques. A further field of attention is the profound analysis of functional dependencies between control parameters, variables of influence, disturbances and dependent quantities of responses in laser material processing. The analyses are performed by means of numerical and experimental approaches.

1 *Laser-based cutting and grooving process*
2 *Nitrogen flow through a cutting gas nozzle left: schlieren imaging right: computed flow field*
3 *Laser remote cutting of a filigree component (diameter 20 mm, period approx. 200 ms)*
4 *Core loss reduction by means of laser processing of electrical steel sheets*

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HIGHLIGHTS

In cooperation with our project partners numerous technological and system developments in the field of ablation and cutting have been transferred into industrial applications. Our highlights include:

- process development for remote "on-the-fly" laser cutting of airbag components and the implementation of this technology as a compact, flexible and highly efficient laser cutting machine with the advantage of high cutting quality and throughput (numerous units worldwide),

- technology and system developments for the laser magnetic domain refinement of electrical steel sheets, used for the construction of transformers; and characterized by core loss reductions. This technology has been implemented with CO_2 lasers and most recently with fiber lasers (numerous units worldwide),

- application of highly dynamic laser cutting systems for the large-scale production of metal and non-metal components (several systems in Germany).