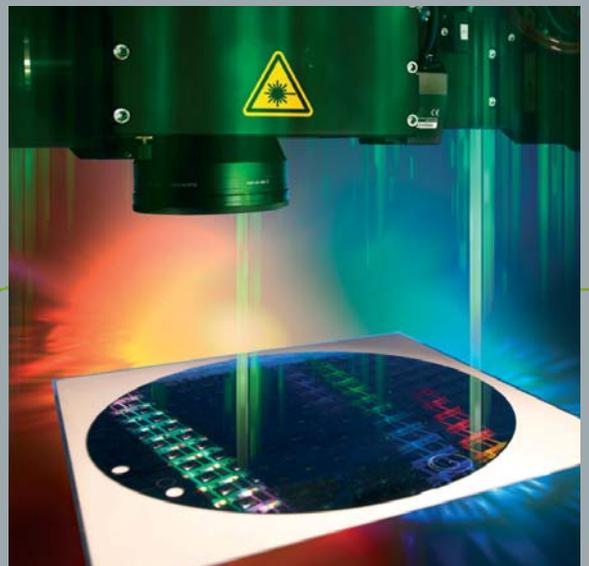


**BUSINESS UNIT  
MICROTECHNOLOGY**



**DRESDEN**





# LASER AS TOOL FOR MICROPROCESSING AND SURFACE FUNCTIONALIZATION

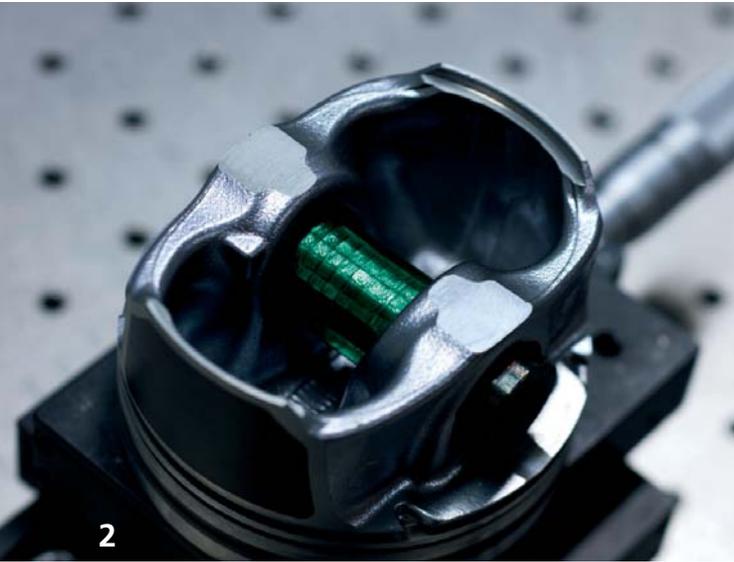
The IWS business unit “Microtechnology” concentrates its research on the development of processes and systems for laser micro processing, surface functionalization and micro and biotechnology. Main foci are the applications with short pulsed and ultra-short pulsed lasers for the processing of diversified materials and design, simulation and prototyping of micro bio systems in various medical biological applications.

## Scientific basis

- laser-based know-how of diversified materials and processes
- procedure and system understanding of laser micro processing
- development of process-adapted systems technology and process control
- design and simulation of optics and beam guiding systems
- simulation and rapid manufacturing of microfluidic components
- development of automation systems for laboratory units in the field of biomedical engineering

## Trend

Increasing miniaturization in the fields of electronic engineering, semiconductor production and biomedical engineering require applications of ever smaller and more precise structures on various substrates. Innovative material developments in automotive, engineering, energy technology and photovoltaics involve new tools and technologically new processing concepts. Short pulsed and ultra-short pulsed lasers with various wavelengths offer new opportunities for highly precise machining tasks. Furthermore, an increasing demand for functionality of 2D and 3D surfaces requires new innovative approaches for the generation of periodic/nano and macro meter structures on large-area components made of polymers, metal, ceramics and coating material.



## OUR COMPETENCIES

### Laser microprocessing

The extensive equipment tool and the corresponding know-how enable us to perform profound research for laser beam microprocessing applications. Our work focusses in the miniaturization of functional elements in engineering, system, automotive and machine construction as well as in biomedical engineering. Examples include the generation of 3D structures in sub-mm range and surface structures in polymers, metals, ceramics or quartzitic and biocompatible materials as well as laser cleaning technologies. Equal to structuring, diagnostics is decisive for process and result understanding. That's the reason why our scientists have specialized on optical laser process characterization with high-speed camera analysis and non-destructive material testing via terahertz radiation.

### Micro and biosystem technology

Research tasks in this field concentrate on the design, simulation and rapid manufacturing of microfluidic structures, micro reactors and complex Lab-on-the-Chip systems. Further research and development priorities are based on 3D scaffold structures, hollow fiber-based perfusion micro bioreactors systems as platform for cell structures.

### Surface functionalization

New techniques for the fabrication of 2D and 3D micro and nanostructures on polymers, metals, ceramics and coatings enable the generation of structured surfaces on large areas and yet provide micro and nano properties. In addition to the topographic modification it is also possible to vary electrical, chemical and mechanical characteristics. These structured surfaces can be used in biotechnology, photonics and tribology.

- 1/2 *Component structured by means of laser interference*
- 3 *Moon-phase display of high-quality mechanical watches with decorative, colored carbon coating and laser structured starry sky (Saxon manufactory)*



Fraunhofer Institute for Material and Beam Technology  
(Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS)  
Winterbergstr. 28  
01277 Dresden, Germany  
Internet: [www.iws.fraunhofer.de](http://www.iws.fraunhofer.de)

Contact Microtechnology:

Dr. Udo Klotzbach (Business unit manager)

Phone: +49 (0) 351 83391-3252

E-Mail: [udo.klotzbach@iws.fraunhofer.de](mailto:udo.klotzbach@iws.fraunhofer.de)

## HIGHLIGHTS

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

- design and development of a multi-organ-chip platform including an automation platform for individualized medical, pharmaceutical and cosmetics research
- THz spectroscopy and tomography for the visualization of hidden mural paintings
- detection of biocides on contaminated cultural heritage via THz spectroscopy
- micro structures on design elements for high-quality mechanical watches via UV laser-based ablation, a technique which allows the fabrication of complex structures
- large-area direct laser interference patterning for applications in photovoltaics and tribology
- design and development of systems and units for laser interference patterning and surface functionalization