Fraunhofer
IWS Dresden

FRAUNHOFER-INSTITUT FÜR WERKSTOFF- UND STRAHLTECHNIK IWS

MICRO MATERIALS PROCESSING

It is not enough just to be small – the great potential of direct write precision processing

Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS
Winterbergstraße 28, 01277 Dresden, Germany

Fax +49 351 83391-3300
www.iws.fraunhofer.de

Contact:
Dipl.-Ing. Volker Franke
Telefon +49 351 83391-3254
volker.franke@iws.fraunhofer.de

info 800-4

Motivation

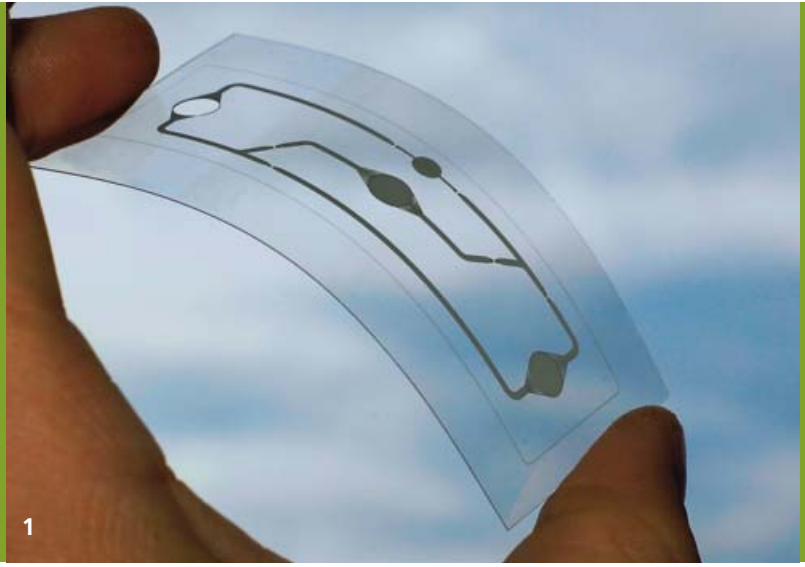
Laser-based and mechanical micro and fine processing are not only used for small-sized components. The surfaces of larger parts have increasingly become the focus of attention in a wide variety of industrial ranges: with targeted surface or point-wise modification of the contact surfaces of communicating components or the environment, tribological properties can be influenced and adjusted for subsequent applications.

Structuring and diagnostics are both decisive in the understanding of processes and samples. Consequently, the work group has specialized in the optical characterization of laser processing using high-speed cameras, as well as in non-destructive analysis by means of radiation in the terahertz range.

Our partners receive application-oriented support from initial feasibility studies to process design up to implementation in series production.

Subject areas

Laser microprocessing is used in many fields. The applications include high accuracy ablation of the widest possible range of materials, microjoining of several material combinations, and surface modification. The use of ultra short pulse laser systems makes it possible to process even transparent materials and thin layers with extremely high precision and minimal thermal effect.



1

2

Selected cases of application

Shaping by ablation
- geometrically flexible micro cutting and drilling and ablation of volumes providing minimal feature dimensions in the 5 µm range
- processing of a wide variety of materials, such as metals, ceramics, polymers, glasses, composite materials and high entropy composites

Selective layer removal and cleaning
- areal or targeted geometrically defined removal of thin layers from basic bodies or multi-layer materials
- low-damage cleaning and structured functionalization without affecting subjacent material layers
- selective uncovering of functional components in compound materials, such as CFRP or GRP

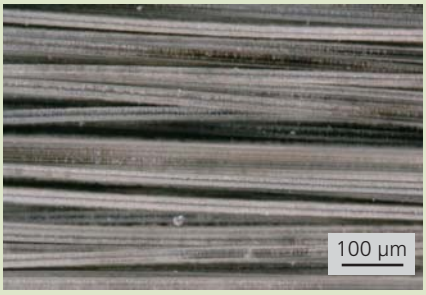
Modification and functionalization of surfaces
- areal or targeted geometrically defined modification of surface characteristics, such as friction coefficient or wetting characteristics
- targeted and defined adjustment of tribological properties for automotive components, bearings or cutting tools
- significant saving potentials due to a reduction in the friction coefficient of up to 25%
- increase in the joining strength in mixed material compounds

Diagnostics in or close to the process
- THz tomography to map hidden inner structures and defects, such as cracks
- high speed image analysis of laser and other processes directly in the process, with up to microscopic resolution

Tribologically efficient laser micro structures on a motor component

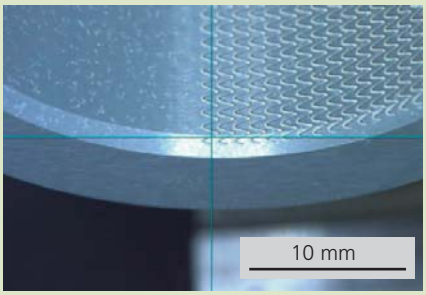
3

Selective uncovering of glass fibers within a fiber composite



4

Microstructures acting as reservoirs in high-performance ceramic bearings



5

Properties of direct micro structuring by laser with ultra short pulses and their advantages

- few or no material limitations
- minimal damage as a result of low thermal influence
- minimal burrs and bulging, high dimensional stability and structural resolution
- high freedom of design and reproducibility
- material-selective processing through precise adjustment of the relevant laser parameters

1 Microfluidic PET module – micro cut, drilled and structured by laser
2 Laser cut PTFE gear