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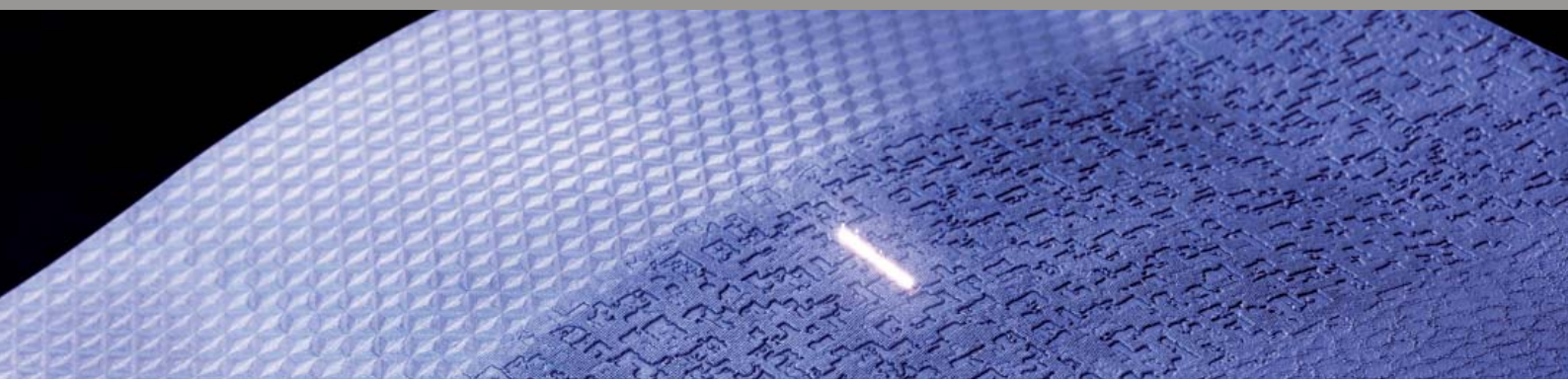

Adaptive laser based micro structuing of complex surfaces

INLINE LOW COHERENCE INTERFEROMETRY AS A TOOL FOR THE PROCESS MONITORING IN LASER BASED MANUFACTURING

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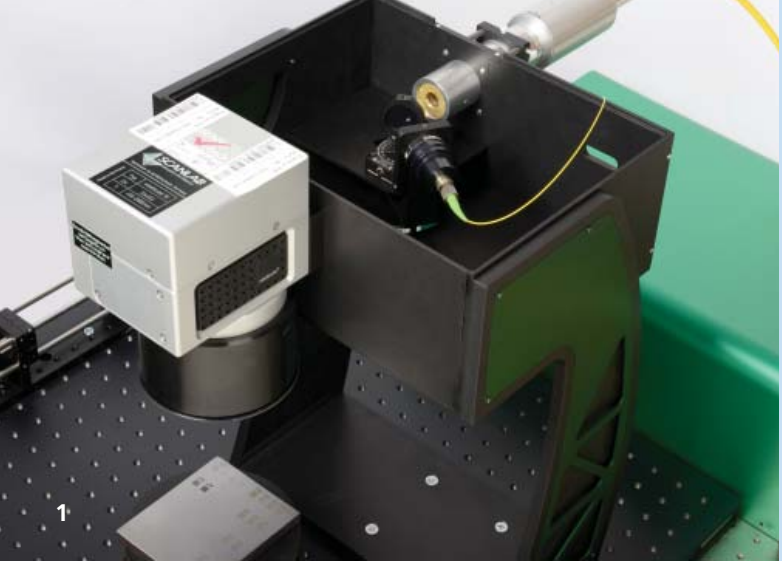
The Challenge

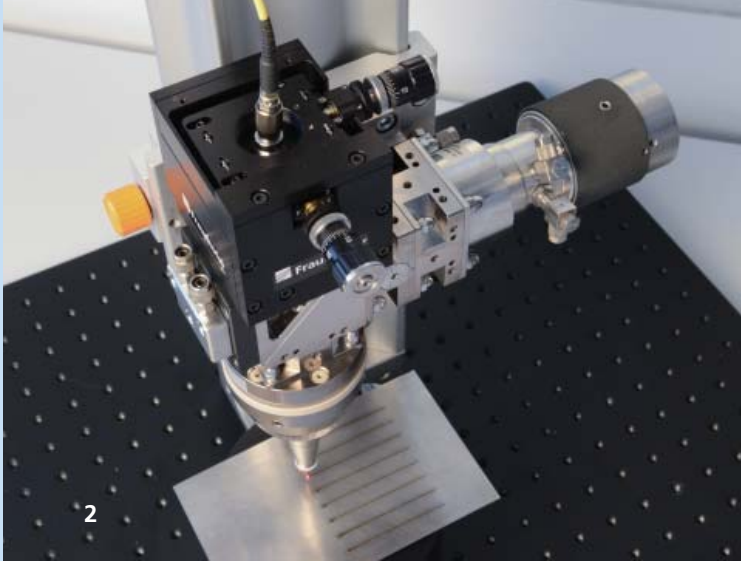
The industrial use of laser processing systems in the micro- and macro-production becomes more important in different industries and applications. Therefore it has established itself as one of the most important tools of production technology. Technical characteristics, such as high precision, reliability, material variety and low thermal load as well as good automation reinforce this development.

However, low component tolerance and short cycle times in this area confront laser processing with new challenges. Considering that laser processes are influenced by different machine, workpiece and environment-related factors, small parameter changes can already cause the produced components to miss the specified tolerances. Therefore, the stability of the process parameters plays an important role. Particularly in the production of precision components, the process window, i.e. the range of allowable parameter deviations, is extremely tight. Thus, monitoring and its consequent regulation is indispensable.

Our Solution

The solution pursued by the Fraunhofer IPT is the machine integration of an own developed measurement system based on the low coherence interferometry. This unit enables consequently a direct process monitoring and a feedback control. The light beam of the measurement system utilizes the same optical path which is used for the laser beam guidance. Here, the modular inline measuring system enables a direct





characterization before, during and after the material processing. This solution represents an innovative and strong alternative to the state-of-the-art sensors in the mentioned area, allowing an accurate as well as material and surface independent monitoring and controlling.

Technical possibilities

Before machining
- Characterization of the workpiece's position and topography for machine aligning as well as adjustment of the machining strategy/CNC code
- Automatic process initialization (laser parameter setting)

During the machining
- Inline measurement of ablation depth
- Detection of process deviations and control
- Inline monitoring the focus position
- Early identification and correction of manufacturing defects

After the machining
- Quality assurance directly in the machine (using machine coordinates)

Material independence
- Inline measurement system/process monitoring can be used with metals, glass, plastics, fiber-reinforced composites (CFRP, GFRP), multilayer systems (OLEDs, solar cells) and ceramics

Integrability
- Evaluation system adjustable on the machine configuration (laser wavelength scanning optics, solid optics) and thus flexibly integrated and applicable
- Integrable with continuous wave (CW), short-pulse/ultra-short pulsed laser systems

Possible use in the following processes

- Laser cutting
- Laser micro machining/structuring
- Laser welding
- Laser transmission welding (polymer-polymer/hybrid welding)
- Laser cladding
- Additive manufacturing (Selective laser melting)

Our service

- Development of special measuring systems and needs-based measurement software
- Project management, requirements analysis, design and implementation
- Integration into your production
- Validation and characterization

AKL ARBEITSKREIS LASERTECHNIK e.V.

Innovation Award
Laser Technology 2014
2nd Place

»Penetration Depth and Topography Measurement in Laser Materials Processing using Low Coherence Interferometry«

1 *Integrated inline measurement system for an adaptive laser based micro structuing of complex surfaces*
2 *Integrated inline measurement system for an adaptive laser based cutting of complex surfaces*