



DIGITIZATION OF LASER-BASED MANUFACTURING PROCESSES FOR INDIVIDUALIZED SERIAL COMPONENTS

Task

Various industries have a growing need for innovative, individualized components for the future markets of automotive, aerospace, photonics and manufacturing. For the first time, the lighthouse project »Go Beyond 4.0« is aiming at dissolving the contradiction between product flexibility and cost-effectiveness of the respective manufacturing processes at a series production scale. By integrating digital production steps into an analog tool-bound process chain, the project will make it possible to produce highly complex products in a highly individualized manner.

Method

The digital production steps are optimized for different substrates (aluminum/thermoplastics) and analyzed for integration into existing process chains (sheet metal forming/injection molding). The functional components to be integrated – in addition to electrical conductors – are printed piezoelectric elements as controls and hybrid integrated piezoelectric elements as ultrasonic-based proximity sensors. In preparation for the integration, structures can be introduced by laser ablation in a location-specific manner, all of which contribute to expanding the functions of the component.

1 *Structured car door with incorporated, individualized functional elements.*

2 *Structure generated by ultrashort pulsed laser radiation for print preparation.*

Results

With a high-performance ultrashort pulse laser (400 W), ablation rates of up to 100 mm³/min in aluminum can be reached, thus making it possible to create 3D surface structures. Simultaneously, the component surface is prepared for a subsequent printing process. This way, individualized functional elements can be selectively introduced, even in large-sized components such as a car door. The assembly for additional modules, such as a wiring harness, is currently very cumbersome. The degree of functional compression, while reducing the component complexity, can be significantly increased in this way.

Applications

The trend towards individualization can be recognized all across the market. In particular, high-tech industries such as the automotive, aerospace and the lighting industry are playing a pioneering role here and are translating the idea of »mass customization« into industrial production.

This project is being financially supported by the Fraunhofer-Gesellschaft.

Contact

Andreas Brenner M.Sc.
Telephone +49 241 8906-8365
andreas.brenner@ilt.fraunhofer.de

Dipl.-Phys. Martin Reininghaus
Telephone +49 241 8906-627
martin.reininghaus@ilt.fraunhofer.de