



INTEGRATION OF PRINTED ELECTRONICS IN LPBF COMPONENTS

Task

Intelligent components that provide data on their production status and condition are a central component of current developments in »Industry 4.0«. By combining thin film processing (TFP) with additive manufacturing, research can pave the way to the production of so-called »smart parts«. The sensors that make these parts »smart« can not only be freely positioned in the component, but can also be manufactured additively, just like the component itself.

Method

Fraunhofer ILT develops process chains for integrating additively manufactured sensors (strain gauges) into additively manufactured components. Additive manufacturing of the component using laser powder bed fusion (LPBF) is interrupted for the integration of the sensor, which is additively manufactured with TFP technology. Here, the different materials and structures are printed directly onto the component layer by layer and then functionalized (sintered, melted, hardened, etc.) using laser radiation. For the production of strain gauges, the insulation layer, the measuring grid and the encapsulation are applied one after the other. The LPBF building process is then continued, closing the cavity and thus fully integrating the sensor into the component.

Results

By means of this innovative process chain, printed multi-material layer systems can be integrated directly into complex, additively manufactured components. The time-consuming preparation of discrete sensors is, therefore, no longer necessary.

Applications

The integration of strain gauges is of interest for a large number of high-quality, heavy-duty components, e.g. in toolmaking, in turbomachinery or in combustion engines. The potential of the process chain is not limited to producing strain gauges, however. Overall, the combination demonstrated here – of »printed electronics« and additive component manufacturing – constitutes a key technology in the production of intelligent components.

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3 Additively manufactured component with printed strain gauge.