



INCREASING THE QUALITY OF ADDITIVELY MANUFACTURED COMPONENTS THROUGH ADAPTIVE PROCESS CONTROL

Task

In laser powder bed fusion (LPBF), geometric shape deviations and, in particular, surface roughness occur since powder particles adhere to the component surface. The causes of these effects include melt pool movements and flows. For this reason, Fraunhofer ILT is investigating how adaptive process control can be applied to LPBF processes: Pulsed wave (pw) laser radiation is used to expose the contour and combined with continuous wave (cw) laser radiation to expose the volume.

Method

Fraunhofer ILT has developed specific process parameters for pw contour exposure experimentally for various component regions and geometric features, such as thin-walled structures and pointed contours. In addition, the institute determined the surface quality and geometric accuracy achievable in each case.

Results

By using pw contour exposure, Fraunhofer ILT was able to reduce both the geometric deviation from the target geometry and the surface roughness as compared to conventional cw contour exposure. This is particularly true for pointed component contours, which are susceptible to excess melting due to heat build-up. This occurs because individual melt baths solidify discretely and independently when the pw process is used, resulting in smaller melt pools compared to cw contour exposure.

Applications

The process control developed at Fraunhofer ILT is suitable for components that have to meet high demands on precision and surface quality. Since it has lower productivity compared to cw process control, selective use in component areas with high quality requirements is recommended. The investigations carried out to date with Inconel® 718 have been in turbomachinery construction. Future investigations will investigate how this process control can be transferred to other materials (e.g. 316L, Ti6AlV4, AlSi10Mg) and, thus, further industrial sectors.

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Contact

Thomas Laag M. Sc., Ext.: -511
thomas.laag@ilt.fraunhofer.de

Christian Tenbrock M. Sc., Ext.: -8350
christian.tenbrock@ilt.fraunhofer.de

1 pw contour exposure.

2 cw contour exposure.