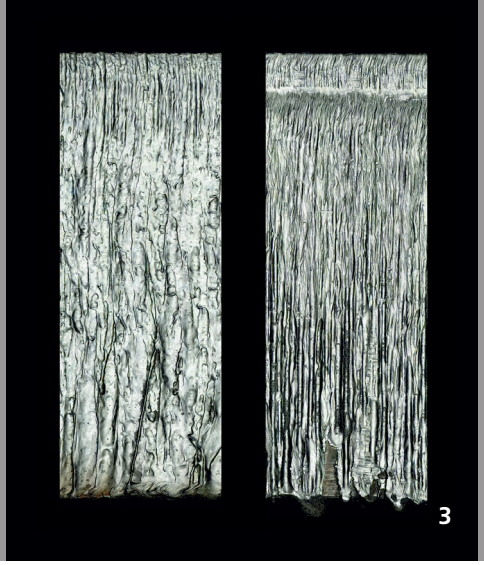

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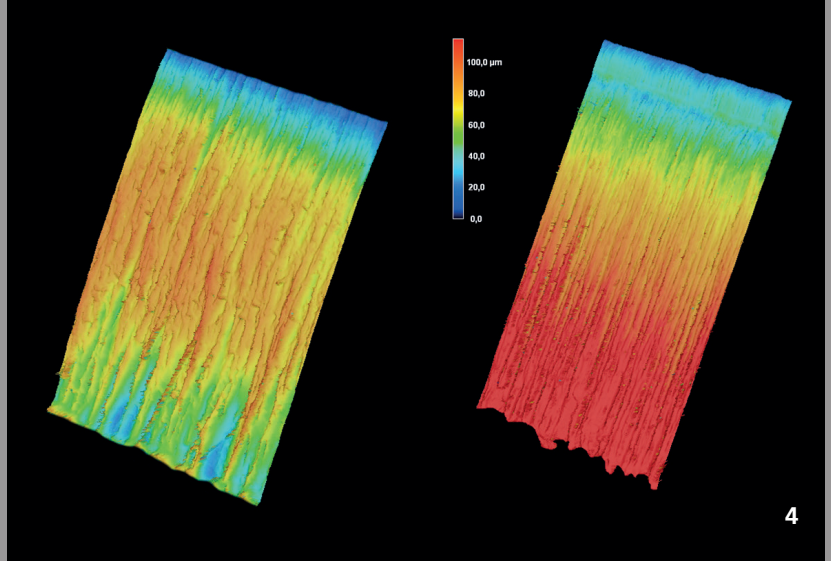

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IN SITU PROCESS DIAGNOSTICS IN LASER-BEAM FUSION CUTTING

Task

In laser-beam cutting, instabilities of the laser cutting front cause unwanted losses in quality in the form of ablation and solidification striations and also lead to dross formation. The in-situ diagnosis of melting and solidification dynamics in laser fusion cutting makes it necessary to create a testing stand to enable optical accessibility of the cutting kerf during the process.

Method

In the trimming process, the workpiece flange is cut along its linear axis with a defined laser-beam overlap. So that a guided supersonic gas beam path along the melt film can be maintained, the missing cut edge is simulated by a transparent replacement edge (protective glass). The quality of the cut edge as it forms is usually indicated at several places in the form of average surface roughness. This quality criterion, however, does not reflect the edge quality in an ideal way, which is why the surface must be viewed integrally.

Result

The testing stand developed for the trimming cuts is equipped with two x/y tables, each with a feed and infeed axis, with which speeds from 0.05 to 120 m/min can be reached with positioning and repeatability of < 2 µm and a parallelism of < 15 µm in the feed direction. In conjunction with an independent camera mounted »off-axis« (opt. resolution < 5 µm), the conditions for the experimental procedure are reproducible.

The trimming cuts carried out by the process described here show promising results regarding its ability to analyze and influence the process. As the test method is gradually adapted, it will approximate the process more accurately.

Applications

The in-situ diagnosis forms the basis for developing process parameters matched to increase cut edge quality while avoiding dross formation.

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3 Photo of a real cut edge (l) and a cut edge created with the trimming process (r).

4 3D view of a real cut edge (l) and one created with the trimming process (r).