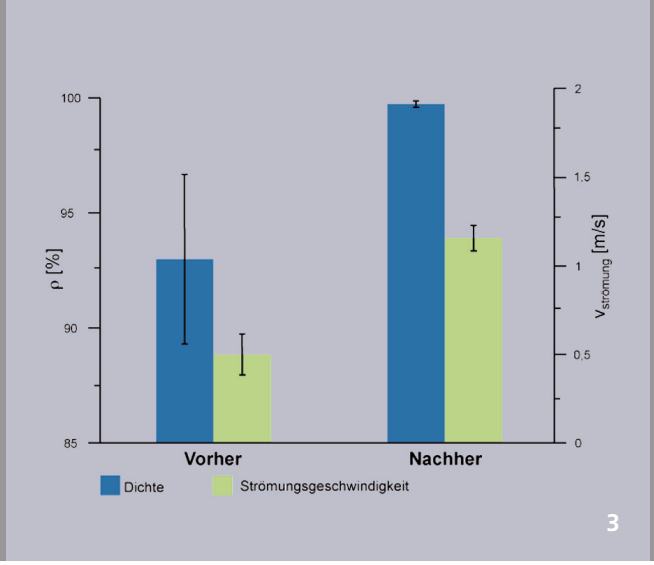

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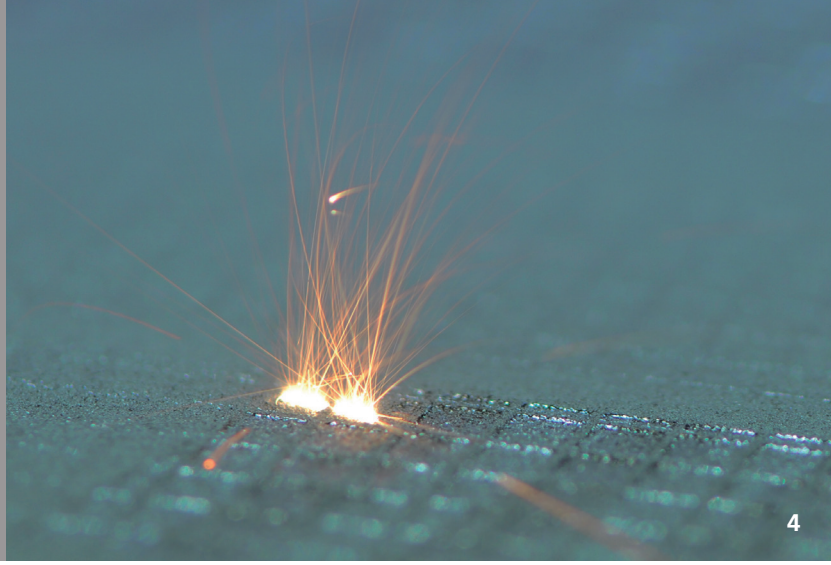

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STUDY OF PROTECTIVE GAS CONTROL IN THE SLM PROCESS

Task

When components are additively manufactured with SLM, their resultant density is an important criterion of their quality. Indeed, not only do the process parameters have a significant impact on component density, but so does the constructive configuration of the machine, such as the shielding gas flow through the building chamber. A central task of shielding gas flow is to remove smoke and splashes from the laser-material interaction zone. If this does not occur sufficiently, the desired component density might not be achieved. Therefore, Fraunhofer ILT is investigating to which extent shielding gas flow correlates with component density.

Method

As a first step, the inert gas flow was characterized by the local flow speed of the gas. This was done using a thermal anemometer, which measures the flow's speed through the construction area at different measuring points before the sample is set up. Then, test specimens were built at these measurement points and the correlation was generated between component density and the flow velocity. To vary the flow field generated through the construction area, various nozzle geometries of protective gas outlet were produced additively and the flow rate was varied.

Result

It has been shown that, with otherwise identical parameters, the local component density correlates with the flow speed of the inert gas. Here, a higher flow rate leads to an increase in component density and to a reduction in local density fluctuations. This is accomplished by adapting the nozzle geometry, which enables an increase in gas flow speed without disturbing the powder bed.

Applications

The results are aimed at equipment manufacturers and users who want to optimize their SLM processes.

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3 Correlation between density and flow rate.

4 Splashes in the SLM process.