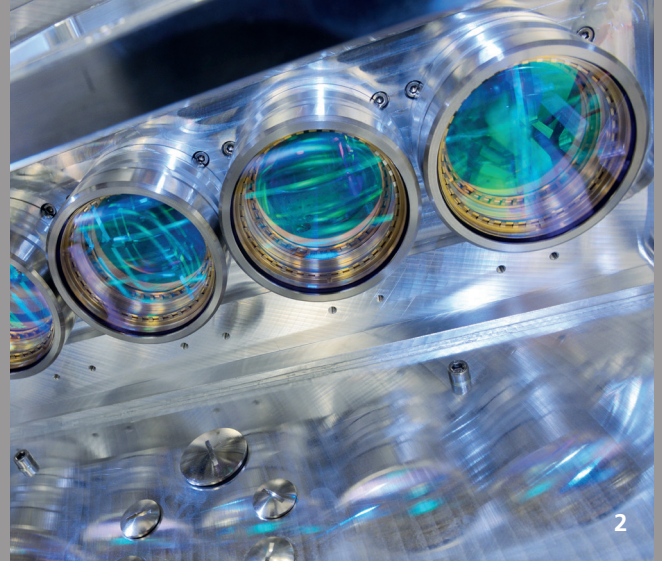




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MULTI-SCANNER PROCESSING HEAD FOR LASER POWDER BED FUSION (LPBF)

Task

To produce large metal components using LPBF, Fraunhofer ILT has developed a scalable machine design with a movable processing head (optical system and local shielding gas guide). The previous prototype only has a single laser scanner unit, which limits the build rate and results in long production times, particularly for large components. As part of the Fraunhofer lighthouse project futureAM, a processing head with five laser scanner units has been developed and tested.

Method

The design of the optical system – in particular the arrangement of the 2D galvanometer units and the shielding gas system – are a central component of the research work. To increase productivity, the institute has searched for a high overlap between the adjacent scan fields. At the same time, the most homogeneously possible shielding gas flow in the processing head must be ensured. As far as the achievable component accuracies are concerned, the optical system must be calibrated so that defects do not occur in the transitions between the scan areas. In addition, suitable processing strategies are required so that the simultaneous remelting processes do not impair each other.

Results

The prototype of the machining head has five compact galvanometer units arranged in a row and a footprint of 200 x 500 mm². Five fiber lasers with a maximum output of 400 W serve as beam sources. By using a simulation to adapt the flow components, Fraunhofer was able to achieve a homogeneous shielding gas flow across the entire width of the processing head. To improve accuracy, the institute also developed a new method for calibrating and aligning the scan fields; to increase productivity, it developed a CAM system that optimizes the scanner utilization in the process and minimizes the manufacturing time. On the basis of manufacturing trials, suitable machining strategies were identified that enable high productivity with high process robustness and component quality.

Applications

Thanks to machine and process technology presented here, LPBF components with a size of up to 1000 x 800 x 400 mm³ can be manufactured reliably and productively. The knowledge gained can be transferred to the development of new, commercial systems.

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Contact

Christian Tenbrock M. Sc., M. Sc.
Telephone +49 241 8906-8350
christian.tenbrock@ilt.fraunhofer.de

1 LPBF process with five simultaneous melting processes.

2 Optical system of the processing head.