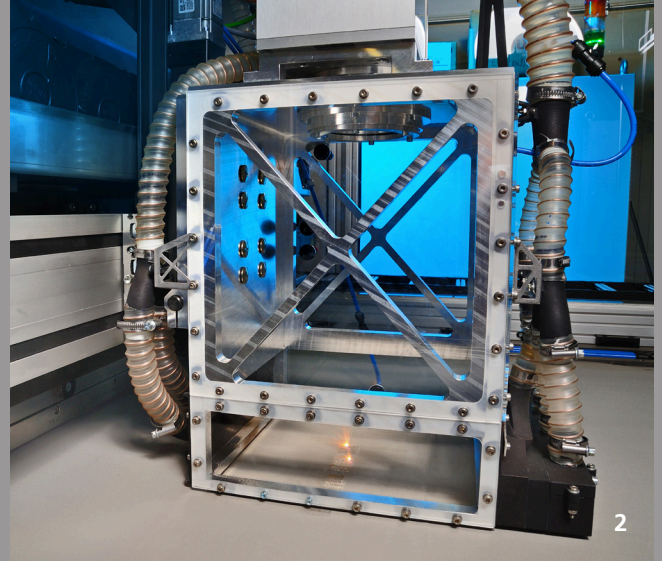


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SCALABLE MACHINE CONCEPT FOR LASER POWDER BED FUSION

Task

Currently, conventional laser powder bed fusion (LPBF) machines are restricted in terms of the size of their build volume. Critical here is the shielding gas flow, which is needed for the extraction of process by-products. As build volume increases, previous shielding gas systems no longer work effectively, which limits component quality and process stability. As part of the Fraunhofer focus project »futureAM«, Fraunhofer ILT will develop a scalable LPBF machine concept which can eliminate current limitations of the build size.

Method

The innovative machine design is based on a movable processing head equipped with local shielding gas flow and an optical system (laser scanner). The processing head is significantly smaller than the build volume and is positioned above the powder bed by means of linear axes. Thanks to the relatively small dimensions of the processing head, the shielding gas system can be set and controlled more easily than a gas flow over the entire powder bed. Thus, an increase in build volume does not require an adaptation of the shielding gas system; solely the axis system must travel longer distances.

Results

To test the machine concept, Fraunhofer ILT developed and built a prototype machine with a build volume of 1,000 x 800 x 500 mm³. On the basis of CFD simulations, components for the local inert gas guidance were designed. With regard to the coupling of linear axis scanner and laser scanner system, the institute has developed a control system and methods for data preparation for LPBF with a movable processing head. In manufacturing tests, the quality of the protective gas flow was proved to be independent of the machining head position in the build volume. In addition, processing strategies for the new kinematics concept were developed and the achievable accuracies and component properties determined.

Applications

With the developed machine and process technology, comparatively large LPBF components can be produced reliably. The insights gained can be transferred to the development of novel commercial systems. The work was carried out as part of the Fraunhofer focus project »futureAM«.

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1 LPBF machining head and process.

2 Building space of the prototype machine.