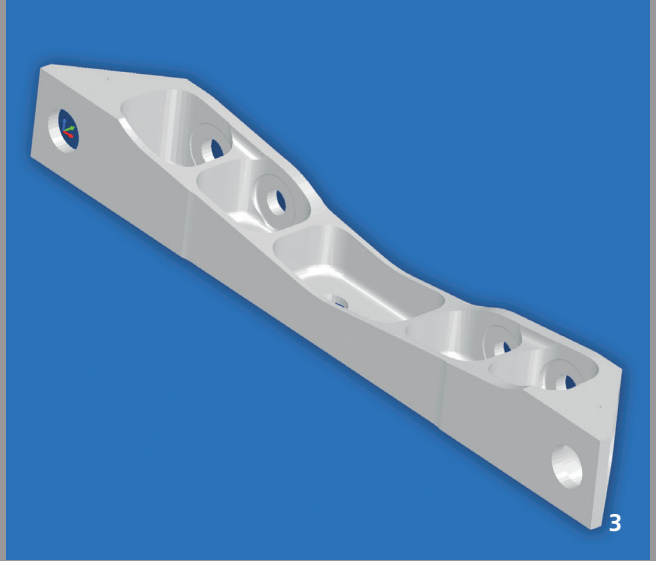

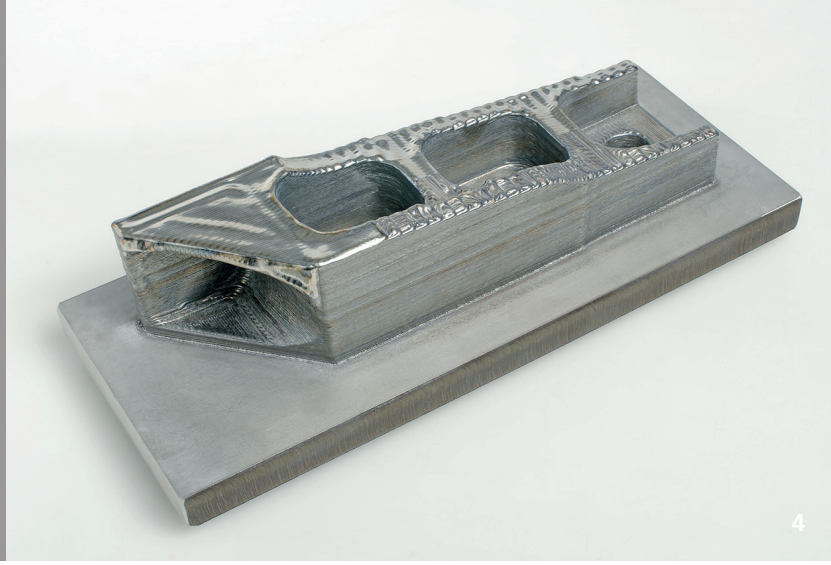

ADDITIVE MANUFACTURING OF A DEMONSTRATOR AVIATION COMPONENT WITH LMD

Task

To produce large, complex and cost-intensive components, e. g. out of nickel-based superalloys, for the aviation industry more efficiently, additional methods such as laser material deposition (LMD) have been under investigation as alternatives to conventional production. For this process to become widely used in the industry, however, the LMD process has to become more cost-effective, in addition to other technological aspects. Significant cost factors are production process time and the subsequent postprocessing. Both points are being investigated within the framework of the EU project »AMAZE« and are to be implemented on an engine suspension as a demonstrator component (Fig. 3) with an increased build-up rate. The demonstrator was produced with local shielding and without a process chamber.

Method

Due to the local inert gas shielding and the oxidation risk caused by this, the surface temperature before the beginning of the next layer was cooled to below 80 °C. The previously conducted parameter tests showed that the higher nominal deposition rates of larger track widths result in prolonged cooling times, which reduce the total build-up rates. Therefore, a track width of 2 mm was selected, providing an advanced build rate with reasonable cooling time and allowing a near net-shape build.

Results

With the established parameter set, half of the engine suspension was successfully built as a demonstrator in a construction time of approx. 11 hours (Fig. 4), the inert gas shielding occurred exclusively through the powder nozzle. Cooling times between the layers accounted for about 4 hours of construction time. The demonstrator component was generated in near-net shape with the aid of the CAM system »LMDCAM«, developed at Fraunhofer ILT for the offline planning of the NC programs. The construction of a support structure with LMD on the back of the substrate plate significantly reduced the deformation of the component.

Applications

The results obtained with the material IN718 can be transferred to other materials and applications. Potential can be found in components that have a high machining volume, for example, integral and engine components from the aviation industry or turbines of high-performance materials for energy production. In tool and mold making, effective and flexible solutions lend themselves to, e.g., the modification of components.

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3 CAD model pylon bracket (source: Airbus Group).
4 LMD demonstrator pylon bracket segment (50 percent - 248 x 65 x 60 mm³).