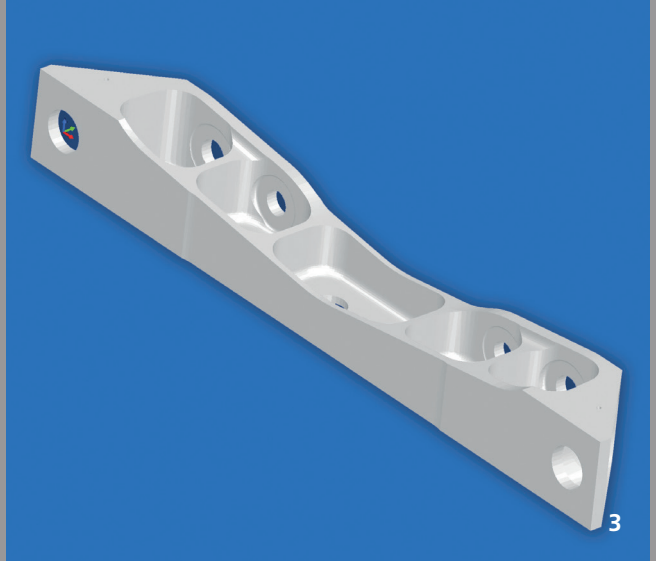

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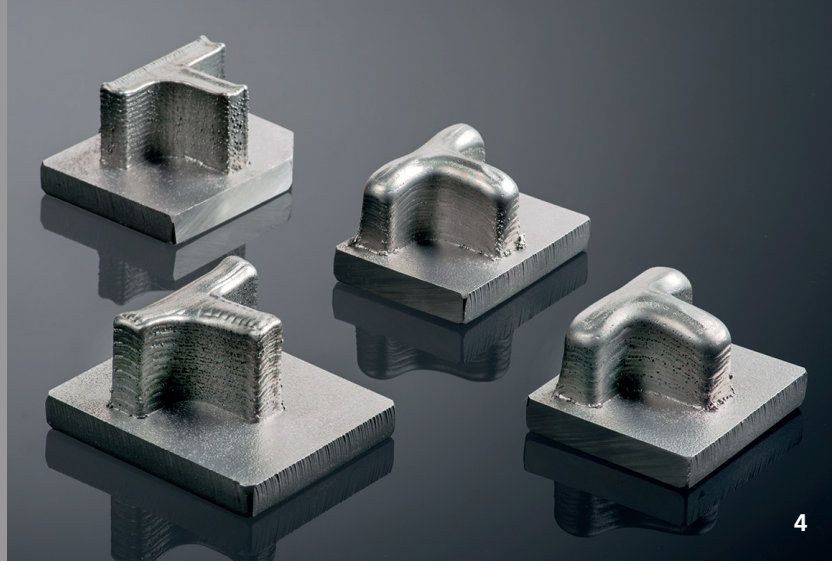

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ADDITIVE MANUFACTURING OF A JET ENGINE MOUNTING COMPONENT BY MEANS OF LMD

Task

So that the aerospace industry can more flexibly manufacture complex and expensive components, such as those made of nickel-base superalloys, additive processes such as laser cladding (LMD) are being investigated as alternatives to conventional production processes. A key consideration for the industrial prevalence of a process is, in addition to technological aspects, its economic efficiency. Two significant cost factors are the running time of the additive manufacturing process and subsequent post-processing. Within the scope of the EU project »AMAZE«, both aspects are being analyzed and tested on the engine mounting component out of IN718 as a demonstrator with increased build-up rate.

Method

From a process-technical point of view, the key factors are the targeted deposition rate, the quality achieved (e.g. pores) and the geometry quality (post-processing time). Among these, the increase in the deposition rate has the greatest potential, which was studied using different beam diameters and laser powers in the range of 500 to 3500 W and subject to a maximum surface temperature of 70 °C before the next layer was applied. Significant geometry elements (features) were extracted from the demonstrator and built with various strategies. These serve as the basis for manufacturing a demonstrator while aiming to minimize the production time.

Result

Parameters were developed using track widths of 1 - 4 mm, with which the feature geometries were generated (Figure 4). The deposition rates achieved of the individual layers varied from 0.15 kg/h at a 1 mm track width up to 2 kg/h at a 4 mm track width. The tests on the feature geometries were evaluated and showed that the deposition rates actually achieved were strongly reduced, especially at the 3 and 4 mm tracks due to the necessary cooling between the layers. By installing active water cooling, the deposition volume rate could be increased again, e.g. by a factor of 4 in the 3 mm track.

Applications

The know-how gained in this project with the material IN718 can be transferred to other materials and applications. Potential can be found in components that have a high volume of stock removal, e.g. integral and engine components from the aerospace industry or turbines made out of high-performance materials for energy generation. In the tool and mold industry, effective and flexible solutions lend themselves to, for example, the modification of components.

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3 Demonstrator component APOD11 (Source: Airbus Group).

4 Demonstrator features with 1 - 4 mm track width (from left to right).