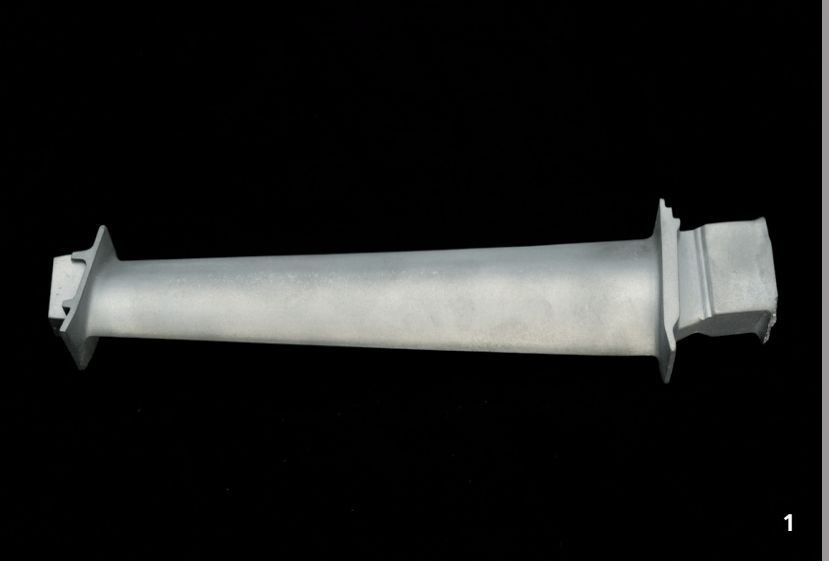

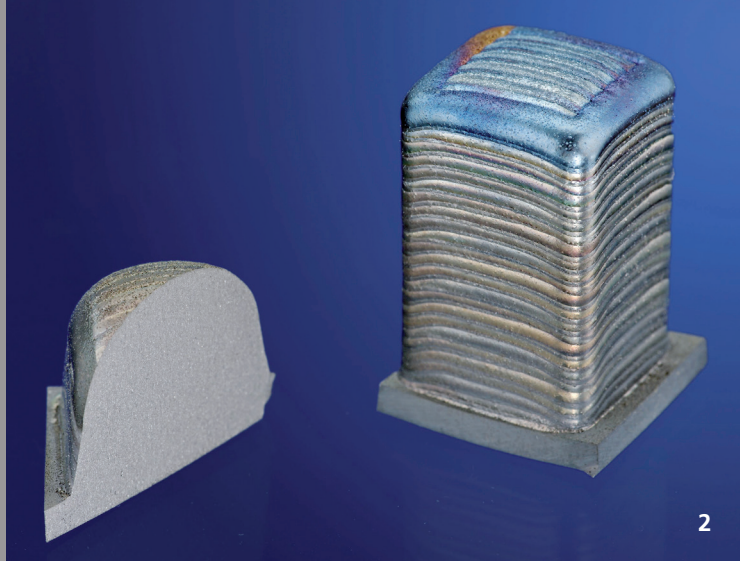

LASER METAL DEPOSITION FOR REPAIR OF JET ENGINE BLADES OUT OF TITANIUM ALUMINIDE

Task

Titanium aluminides combine light weight and high strength with high corrosion resistance. For these reasons, they are increasingly being used in the aerospace industry, especially for low pressure turbine blades, which operate at temperatures of approx. 700 °C. While Laser Metal Deposition has already become established as a repair method in the field of aircraft engines, e.g., for Ni-based super and titanium alloys, an appropriate technology for the repair of TiAl blades (manufacturing defects and wear) does not yet exist. Both brittleness and great oxygen affinity present particular challenges when using LMD with and on TiAl.

Method

Within the LuFo project »REPTIL« (funded by the BMWi), partners from industry (Laservorm, Mabotic, TLS) and research (Access) have been jointly developing a full process chain since the beginning of 2014. This chain reaches from component detection, via LMD to repair similar materials, all the way to reworked and operational turbine blades. Fraunhofer ILT is developing the process control for the preheating (> 750 °C) and suitable protective gas shield to produce both crack-free and low-oxygen volumes. To this end, appropriate process parameters have been determined in the first step. Subsequently, machining strategies will be adapted to the geometric conditions of the respective service areas of a turbine blade.

Result

First cubic test samples (edge length approx. 10 mm) from the TiAl alloy GE4822 could be produced without cracks in an Ar-inert atmosphere at preheat temperatures of 780 °C. Currently, the project partners are examining heat treatment, determining the microstructure and identifying mechanical properties.

Applications

The project has focused on developing a technology transferable to a variety of blades, types of defects and other brittle metallic materials. The process is, thus, attractive for a variety of applications in the aerospace industry and energy generation.

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1 TiAl turbine blade.

2 LMD-generated specimens out of TiAl.

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