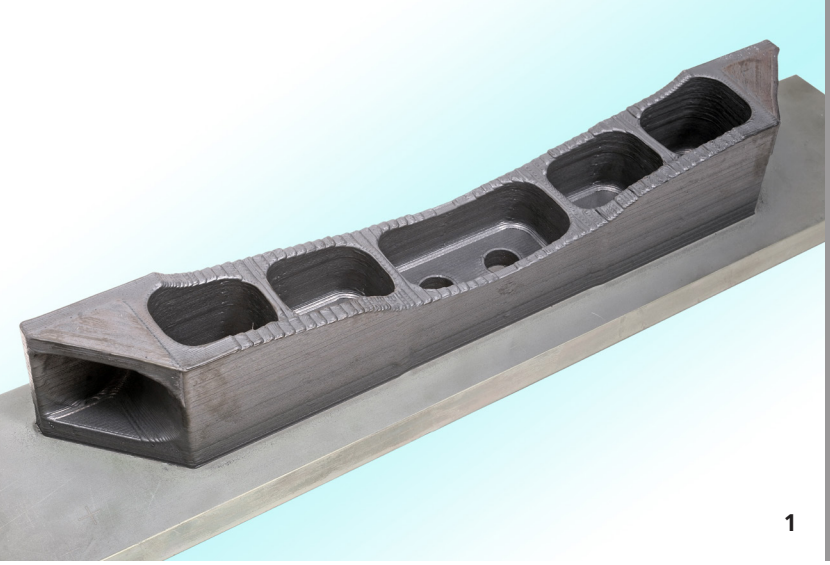
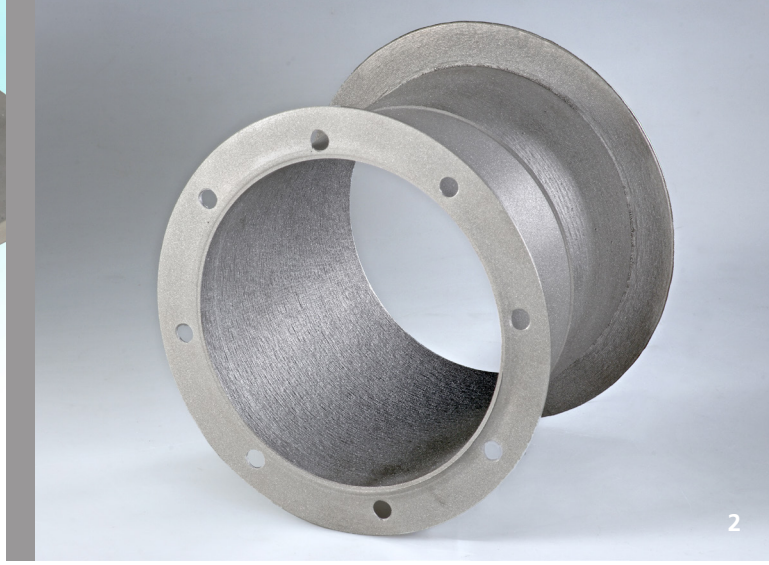


1



2

ADDITIVE PRODUCTION BY LASER MATERIAL DEPOSITION WITH HIGH DEPOSITION RATES

Task

Since many components made out of Inconel® 718 (IN718) in the aerospace industry are manufactured in small batch sizes or must have large amount of material ablated, there is a great need to manufacture these components additively. One of the disadvantages of the powder bed-based additive process, however, is its comparatively low productivity since the deposition rate is still very low. Typical deposition rates in laser material deposition (LMD) of IN718 are currently less than 0.5 kg/h. In order to increase the productivity of the process, Fraunhofer ILT is conducting investigations to increase the deposition rate by using higher laser power.

Method

Initially, the institute carried out fundamental investigations on the LMD process with higher laser powers (up to 4 kW). In order to set variable track widths, it used a zoom lens. For the powder feed, a coaxial powder nozzle was modified in such a way that high powder mass flows (up to 3 kg/h) can be processed and the powder nozzle can withstand the high laser powers. So that large components can be protected from oxidation during production, a precise adjustment of the process conditions is required. For this purpose, a local inert gas shielding was developed and built.

1 LMD demonstrator 1: Pylon bracket segment (496 x 65 x 60 mm³).

2 LMD demonstrator 2: Cylinder geometry with flanges (150 x 150 x 185 mm³).

Results

The developed process can reach deposition rates of up to 2 kg/h. The mechanical properties (tensile strength, yield strength and elongation) of the deposited specimen meet the relative requirements of AMS5596. Various demonstrator models were produced with adapted system technology and the developed process parameters. Demonstrator 1 is a real aerospace component (engine mount) manufactured at an application rate of 0.6 kg/h and 85 percent powder efficiency. The demonstrator component 2 was produced with a deposition rate of about 1.2 kg/h at a powder efficiency of about 60 percent.

Applications

Potential for the additive manufacturing can be found in all components that have a high volume to be machined, e.g. components from the aerospace industry or turbine parts made of high-performance materials for energy production.

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Contact

Dr. Chongliang Zhong
Telephone +49 241 8906-8053
chongliang.zhong@ilt.fraunhofer.de

Dipl.-Ing Jochen Kittel
Telephone +49 241 8906-136
jochen.kittel@ilt.fraunhofer.de