

TRUMPF Additive Manufacturing to boost aerospace



TRUMPF enjoys an excellent reputation in the aviation and aerospace industry. In the various areas of application for the lasers, TRUMPF meets the stringent quality requirements for repaired or additively manufactured components such as turbine, compressor and blisk blades. Thanks to their precision and flexibility, 3D printing systems are predestined for these tasks and are shaping the future of manufacturing in this industry. TRUMPF is the only manufacturer in the world to offer all relevant laser technologies for additive manufacturing from a single source: laser metal deposition (LMD) as well as laser metal fusion (LMF) / powder bed fusion (PBF).



Laser Metal Deposition

Laser Metal Fusion (LMF) / Powder Bed Fusion (PBF)

TruLaser Cell 3000 +7040

The allrounder among additive systems

- Laser metal deposition – from coating to repair through to additive manufacturing
- The right beam source and powder feeder for every application
- High-speed laser metal deposition for rotationally symmetric components

TruPrint 3000 \varnothing 300 × H 400 mm

Flexible solution for industrial 3D printing

- Maximum productivity through full-field multilaser 2 × 500 W
- High process reliability due to newly developed gas flux
- Flexible production setup
- Ensuring high quality standards with Automatic Multilaser Alignment
- Inert, closed powder cycle
- 3D printing of aluminum with 2 × 700 W

TruPrint 1000 \varnothing 100 × H 100 mm

3D printing in premium quality:
Highly productive and compact

- Highest build rates and machine runtime
- Superior part and surface quality
- Ergonomic contact-free powder handling
- Process flexibility and advanced monitoring
- Lower part costs due to preform, multiplate and hybrid digital chain

TruPrint 5000 \varnothing 300 × H 400 mm

Highly productive and semi-automated
3D printing system

- Full-field multilaser 3 × 500 W with Automatic Multilaser Alignment for high part quality
- Preheating up to 500°C (optional)
- Inert, closed powder cycle
- External part and powder management compatible for TruPrint 3000 and TruPrint 5000
- Preform option for hybrid manufacturing

TruPrint 2000 L 202 × W 202 × H 200 mm

Productivity squared

„World Premiere“

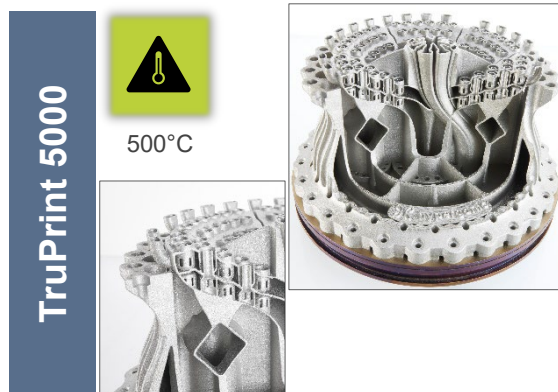
- Process flexibility due to adjustable beam diameter (55/80 μ m)
- Highly productive due to full-field multilaser option 2 × 300 W (opt. 2 × 500 W)
- Low part costs due to perfectly tailored machine concept
- Highest quality standards through Melt Pool Monitoring
- Inert, closed powder cycle

TruPrint 5000 Green Edition

3D printing of copper and copper alloys

- Unique combination of green laser and additive manufacturing system
- Highest quality and productivity thanks to green laser with wavelength of 515 nm
- Outstanding thermal and electrical conductivity for printed copper parts

Additive manufactured applications for the aerospace sector



Rocket injector ring

Dimensions: \varnothing 285 × 145 mm Build time: 27.8 h
Number of layers: 2,410 à 60 μ m Material: Ti6242

- Do it once, do it right!
- Manufactured with 500°C preheating to reduce tension in-situ during build-up
- High-performance alloy offering excellent mechanical strength, stability, good corrosion and creep resistance to temperatures as high as 600°C
- Residual stress significantly reduced and productivity increased
- Process safety and lower costs per part due to robust process parameters
- Fulfilling Safety Class QL1 AIMS03-22-000, attested by Zeiss CT Scan inspection with all defects < 200 μ m

Satellite thruster

Dimensions: \varnothing 60 × 180 mm (h) Build time: 14.4 h
Number of layers: 4,339 à 40 μ m Material: Pure nickel or niobium (C-103)

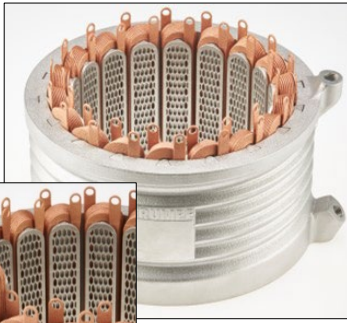
- Very efficient and economical design
- Parts from niobium: Can be used in the temperature range from -150°C to > 1000°C



TruPrint 2000



Green



E-drive concept demonstrator

Material: Pure copper + aluminum

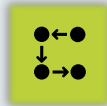
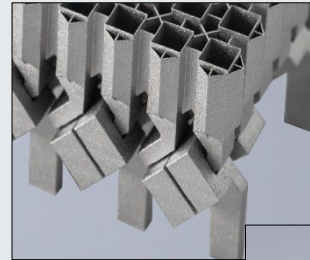
- Maximum part and motor performance thanks to the electrical conductivity of pure copper with 101% IACS and an internally cooled housing
- Enhanced cooling properties due to internal cooling channels; housing made of aluminum or ferromagnetic material

Satellite antenna demonstrator for K_a-band telecommunication

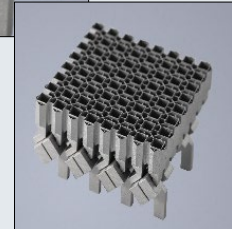
Dimensions: 40 × 40 × 40 mm Build time: 18 h (4 antennas)

Number of layers: 1,994 à 20 µm Material: AISi10Mg

- Reduced signal loss due to a monolithic design resulting in improved performance (not possible with conventional processing)
- Increased component performance, including lightweight construction and complex structures



Serial production

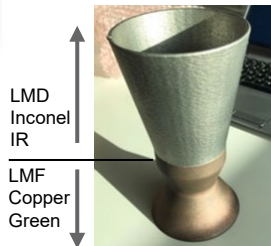


Laser Metal Deposition Cladding

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Green



LMD
Inconel
IR

LMF
Copper
Green

Combustion chamber reinforcement and extension via LMD

Material: CuCr1Zr / nickel coating (sample)

- LMF process with green laser: Good printing resolution and very detailed features
- Flexibility and enhanced structural properties under higher temperatures by means of nickel coating via LMD

Highlight LMD

- Increase of buildn volume by LMD or use of modified free-form geometry
- Build volume not dependent on a build platform, limited only by machine size
- Internal cooling channels feasible

Highlight LMF / PBF

- Combustion system with more than 200 ultra-fine cooling channels in which hydrogen gas circulates enables cooling of nozzle to < 100°K

Processing optics for LMD with new highspeed-LMD nozzle

DepositionLine Package for integrators

- NC-controlled adjustment of beam diameters by motorized collimation
- Feature resolution of 0.2 to 4.0 mm feasible
- Complete package for system integrators: DepositionLine with TruDisk laser with powerful IR or innovative green laser beam for processing highly reflective materials such as copper, aluminum, etc.
- High-speed laser metal deposition thanks to appropriate nozzle for coating rotationally symmetrical parts at up to 1500 cm²/min; typical coating thicknesses: 100 to 300 µm



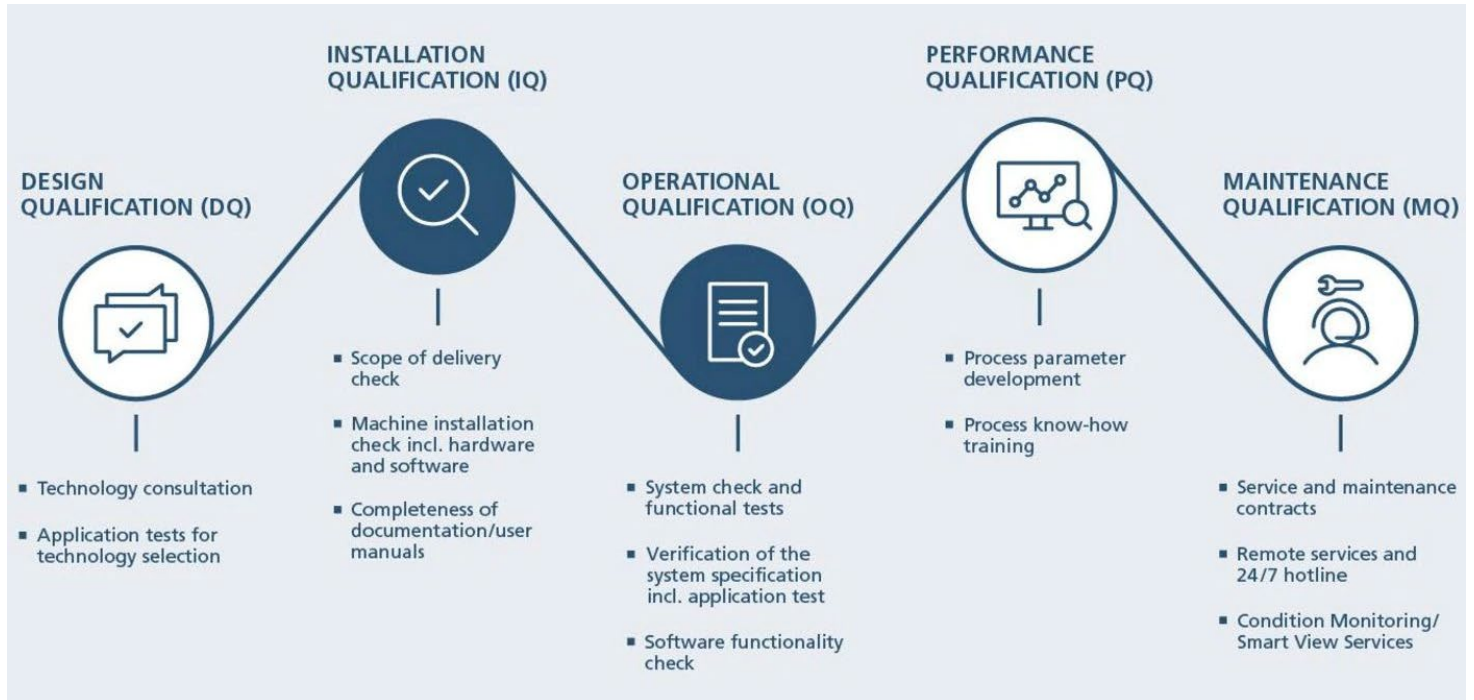
LMD-processing optic with powder nozzle



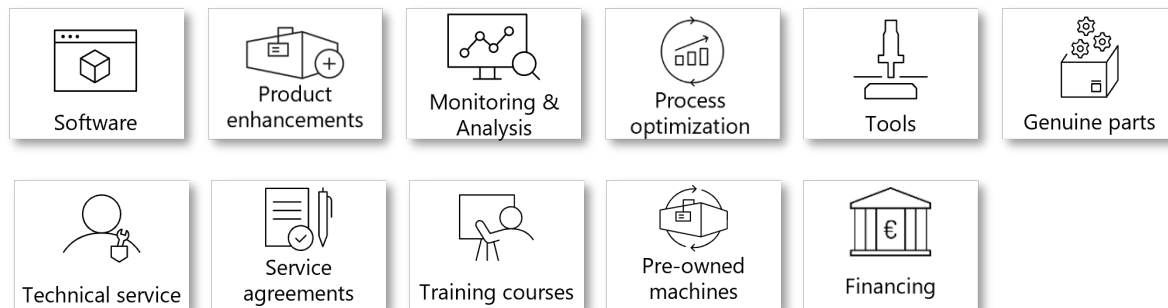
Laser Metal Deposition Cladding

With TRUMPF you are not only buying a machine but an industrial solution

It can be quite challenging to have your laser system certified in regulated industries, but not with TRUMPF qualification experts who provide you time- and cost-saving support throughout the qualification process and constantly continue to develop their range. Our focus is on the particularly comprehensive standards and requirements from the aviation and aerospace sectors amongst others. This way, our services are oriented primarily toward the requirements of standards and institutions: NADCAP, ISO/ASTM 52941 and 52942, ISO 9100 and others.



Our services



You can find more information online at https://www.trumpf.com/de_INT/loesungen/branchen/luft-und-raumfahrt/
Or contact our experts directly: additive.manufacturing@trumpf.com

Would you be interested in seeing the machines or having a virtual demonstration of our 3D printers? Make an appointment now at www.trumpf.info/am-showroom.