Laser Surface Engineering LSE
Laser Metal Forming and Cladding

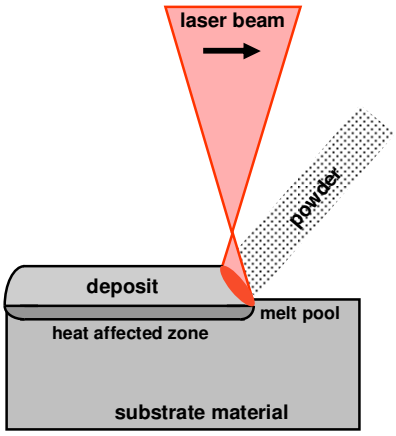
Sulzer Innotec

The good focusing ability of the laser allows power densities that are hardly possible with conventional thermal procedures. Thus, the desired component processing can be carried out on a limited area with low overall power – the component and the material are only subject to minimal thermal loading. Laser build-up welding is thereby particularly suitable for applications in tool and mold manufacturing, in which only minimum distortion can be tolerated, as well as for materials that are difficult to weld using conventional methods, for example, high-temperature resistant nickel-based alloys in gas turbines.

Laser Metal Forming (LMF) and Cladding (LC)

Laser metal forming and laser cladding are related to the conventional TIG (Tungsten Inert Gas) and PTA (Plasma Transfer Arc) build-up welding processes. In place of the electric arc or the plasma, however, a laser is used as the heat source. The powdery build-up material is transported in an inert carrier gas, and is brought via a powder nozzle to the melt pool created by the laser.

Our mobile 1.5 kW Fiber-Laser system can be used for on-site laser metal forming and cladding applications. Our 6-axes gantry robot with a 2 kW CO_2-Laser allows laser applications on large and complex part geometries. Small repairs on precision parts as well as large parts can be done with our mobile, hand operated 150 W Nd:YAG-Laser system.



Benefits

The essential advantages of the build-up laser welding process are

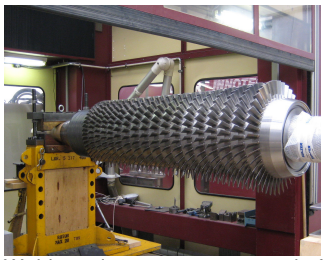
- Minimal distortion due to the small, localized heat input
- Small heat affected zone, therefore minimal modification of the substrate material
- Perfect metallurgical bonding
- Surface coating as well as weld build-up of edges
- Near net-shape welding, less finishing effort
- Broad range of build-up materials
- Joining of difficult combinations of materials

Examples

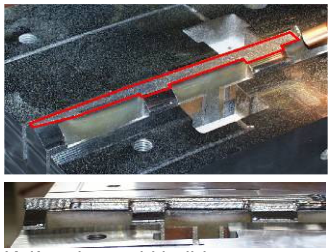
Laser metal forming on turbine components


Blade tip welding


5-axes laser claddin on turbocharger blades


Weld repair on a compressor shaft

Laser metal forming on mold tools for repair


Knife edge weld build-up
200 x 10 x 10 mm


Correction of a curved geometry with undersize, 0.7 mm thickness


Precision build-up, 0.25 mm thickness

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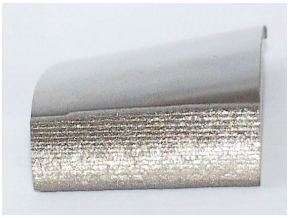
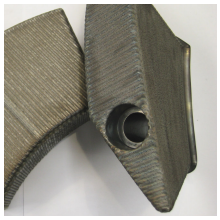
Beispiele

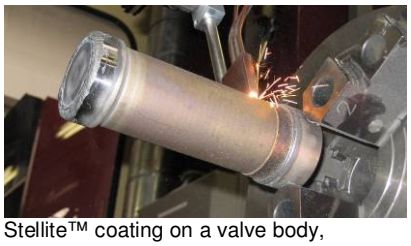
Laser cladded wear protection coating on steam turbine components



Stellite™ coating on the blade leading edge for droplet erosion protection



Hardfacing of stone-crushers with Tungsten-Carbide



Stellite™ coating on a valve body, 0.7 mm thickness sufficient due to minimal dilution

Typical Materials

Nickel-based alloys
IN718, IN738, IN792, IN939, MarM247, CMSX-2, CMSX-4, PWA1480, Nimonic 80A, Rene80, Haselloy, et al.

Build-up materials
IN625, IN718, IN738, MarM509, CMSX-2, CMSX-4, Hastelloy, et al.

Stainless steels
1.4021, 1.4301, 1.4310, 1.4313, 1.4435, 1.4550, 1.4571, 1.4404, 1.4057, 1.4462, 1.4112, 1.4923; et al.

Alloyed tool steels
1.2083 (X42Cr13), 1.2343 (X38CrMoV5-1), 1.2379 (X155CrVMo12-1), et al.

Coatings
Stellite™, Tungsten-Carbides, special compositions

Our Partners

Highly qualified experts at Innotec are our partners for

- One-stop-shop manufacturing solutions, manufacturing and welding engineering and consulting
- Mechanical precision workshop and prototyping
- Conventional welding processes and heat treatment
- Testing and metrology
- Material and surface technology
- Corrosion and corrosion protection, friction and abrasion
- Material and failure analysis

Equipment

1.5 kW Fiber-Laser system
5+2 CNC-axes
X-Y-Z 0.5 x 0.5 x 0.7 m
B,C,D,E ±180°,360°,360°,±90°
On-site operation possible

2 kW CO_2-Laser system
Gantry robot, 6 CNC-axes
X-Y-Z 2.7 x 1.8 x 0.9 m
A,B,C 360°,±90°,360°
Integrated digitizing system

150 W Nd:YAG-Laser system
Peak pulse power 10 kW
Boom range 1.2 m
Hand operated
On-site operation possible

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