

Making Light Work

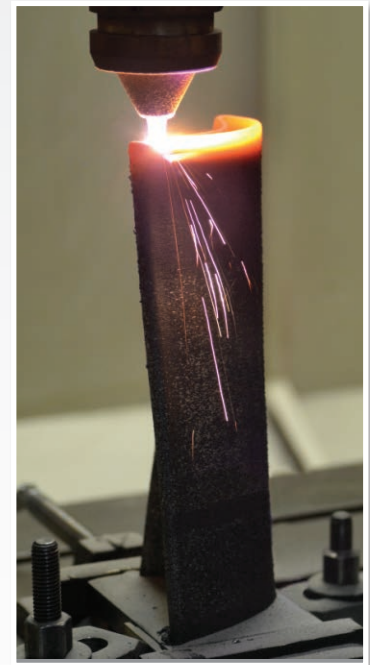


Laser Additive Manufacturing of an Aerospace Nozzle Demonstration Component

Laser Additive Manufacturing

Fraunhofer is one of the pioneers in the growing field of additive manufacturing. Our process expertise includes the development of a range of state of the art powder delivery nozzles which enable precise placement of the metallic powder material relative to the laser beam focus. Also, we have developed a coaxial wire system which enables multi-directional wire deposition for additive manufacturing.

Our proprietary process monitoring and control technology and CAD to tool path generation software enable us to generate complex tool paths for build-up of high quality prototype components. Our CNC and robotic cells have up to 4 meters (13 feet) x 2.5 meters (8 feet) work envelope which enables large scale additive part construction which is not possible using powder bed technology.



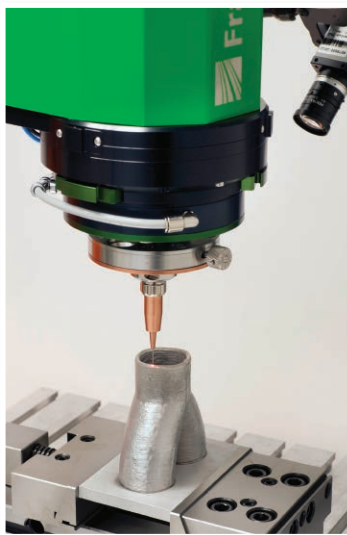
Laser Additive Manufacturing of a Turbine Blade Demonstrator

ADVANTAGES

- Low heat input / distortion
- Precise control of microstructure
- Minimal post machining requirements
- Functionally graded parts can be produced

APPLICATIONS

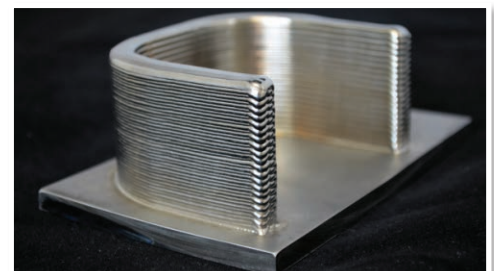
- Repair and rebuilding of turbine components
- Rebuilding of tooling and dies
- Creation of complex 3D components
- Rapid Prototyping
- Laser wire additive manufacturing



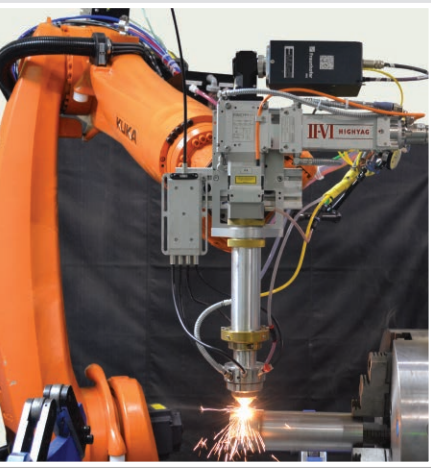
Coax Wire Head



Screw Thread Build up using COAX Powder Technology



Titanium Test Part Produced with COAXwire (in Co-operation with GKN Aerospace)



Fraunhofer Coax 8 Powder Head with EMAQS Camera mounted for coaxial process viewing and melt pool size control

Process Monitoring and Control – EMAQS

Process monitoring and control is becoming increasingly important for laser cladding and additive manufacturing applications.

Fraunhofer's EMAQS is a camera based process monitoring and control system which can view the process either coaxially through the laser processing optics or off axis from the side of the optics.

For laser heat treatment applications the EMAQS camera is

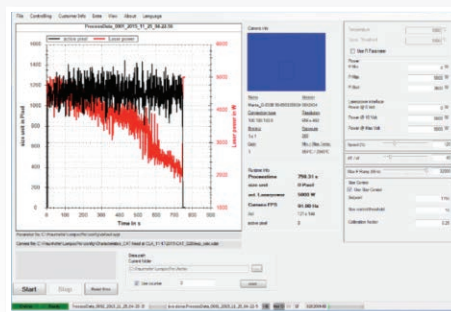
used to monitor part surface temperature and then the Lompoc Pro software is able to closed loop control laser power in order to provide consistent heat input and heat treatment results.

For laser cladding and additive manufacturing the same system can be used to monitor and control the melt pool size so that the laser power can be continually adjusted to provide a consistent results.

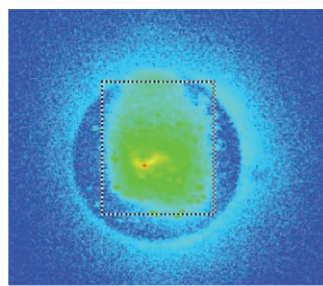
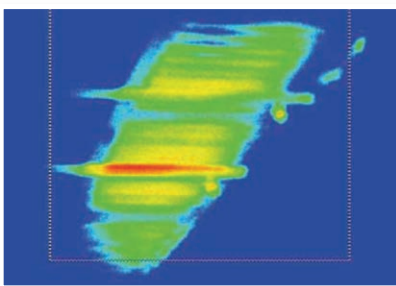
This is extremely beneficial for parts where there are issues caused by part heating over time or changing part geometries or materials which require the automatic adjustment of the laser power in order keep the melt pool size and heat input constant.



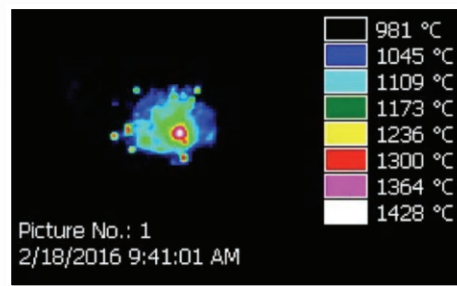
Fraunhofer IWS Coax Wire Head with EMAQS Camera mounted for coaxial process viewing and melt pool size control



Lompoc Pro Software controls laser power to maintain constant melt pool size



Thermal images from EMAQS Camera System



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APPLICATIONS

- Powder Deposition for Laser Cladding
- Powder Deposition for Additive Manufacturing
- Wire based deposition including Coax Wire Processing

Fraunhofer
USA
Center for Laser Applications