



- 1 *COAXshield effectively simplifies protecting the workpiece during Laser Metal Deposition.*
- 2 *The novel inert gas nozzle shields the local melt pool of reactive materials.*



“COAXSHIELD” – LOCAL INERT GAS SHIELDING FOR ADDITIVE MANUFACTURING

NEW INERT GAS NOZZLE FOR LASER POWDER CLADDING OF TITANIUM COMPONENTS

Additive manufacturing enables the manufacturing of highly complex components that can only be produced with great effort or even not at all with conventional machine tools. With the “COAXshield” Fraunhofer IWS expands its nozzle portfolio and optimizes the process of Laser Metal Deposition with a simplified but effective protection of the manufacturing object. This reduces the set-up time and maintains the material quality of the components, e. g. titanium. In fact, the material oxidizes when heated to 300 degrees Celsius or more. As a result, the material properties change, the components become brittle and may crack.

Process design so far

Until now, the additive manufacturing of a titanium workpiece, for example, required a multi-stage preparation process to prevent

undesired reactions. The component had to be encased in a spacious chamber that was either filled with noble gases (helium, argon) or in which a vacuum had been generated. Although the process could be shielded globally, the economic production possibilities were reduced to small component sizes. The effort involved was similar for workpieces made of so-called refractory metals, such as tantalum, niobium or titanium-aluminum compounds.

The alternative

With “COAXshield”, Fraunhofer IWS has developed an alternative protective shield which directs the inert gas only to the region where it is really needed: directly into the area around the processing zone of the laser beam, which melts the metal powder and applies it to the component layer by layer.

Fraunhofer Institute for Material and Beam Technology IWS

Winterbergstraße 28
01277 Dresden
Germany

Contact

M. Sc. Jakob Schneider
+49 351 83391-3889
jakob.schneider@iws.fraunhofer.de

Dr. Elena López
+49 351 83391-3296
elena.lopez@iws.fraunhofer.de

www.iws.fraunhofer.de

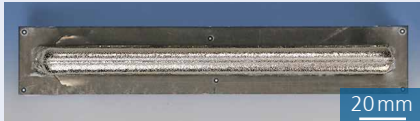
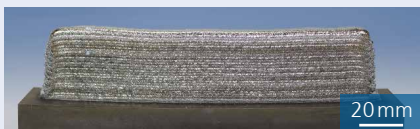
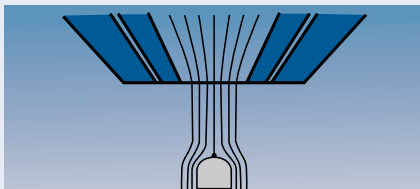


3

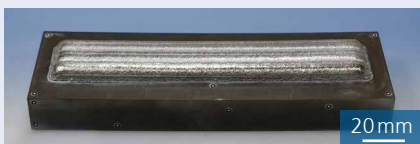
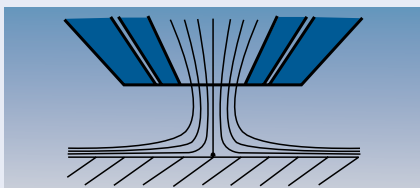
3 The new Fraunhofer IWS nozzle head "COAXshield" encases the powder nozzle and forms an inert gas cone coaxially around the process zone.

Demonstration of the shielding effect using representative applications for additive manufacturing:

Manufacturing of thin bars



Production of block-shaped volumes



The nozzle head can be mounted on standard processing optics. It encases the powder nozzle and forms an inert gas cone coaxially around the process zone. This cone thus only protects the hot processing zone, because only here can highly reactive materials and the ambient air react with each other.

The advantages of COAXshield

- Simplified and more flexible manufacturing process
- Expansion of the production portfolio from small to large components
- Cost reduction thanks to reduced use of noble gas, which increases disproportionately to the size of the component
- Time reduction due to no need for evacuation and flooding phases and shorter process interruptions
- Maintaining the component's material quality due to a residual oxygen concentration of less than 300 ppm within the process zone

Applications

- Primarily for the processing of reactive materials such as titanium, aluminum and refractory metals
- Large components with diameters of several meters, such as in the satellite carrier structure made of titanium for the X-ray space telescope "ATHENA"
- Welding processes

Key data

Height x width x depth	362 x 170 x 170 mm
Weight	approx. 10 kg
Height adjustment for adaptation to different beam paths	± 40 mm
Diameter nozzle opening	50 and 70 mm (others on request)