

# COAXshield

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## Local Inert Gas Shielding for Direct Energy Deposition

Direct Energy Deposition can be used for the repair, modification and coating as well as for the production of complex parts. With "COAXshield" Fraunhofer IWS expands its nozzle portfolio and optimizes the process of Direct Energy 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.

### 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. That's because the material oxidizes when it is heated. As a result, the material properties change, the components become brittle and may crack. The component must be enclosed in a spacious chamber that is either filled with inert gases (helium, argon) or in which a vacuum is created. Although the process can be completely shielded, economical production is limited to small component sizes. The effort for components made of so-called

refractory metals, such as tantalum, niobium or titanium-aluminum compounds, is similarly high.

### The Alternative

With "COAXshield", Fraunhofer IWS has developed an alternative protective shield that guides the shielding gas to where it is really needed: directly into the area around the processing zone, where the laser beam melts the metal powder and applies it to the component layer by layer. The nozzle head can be mounted on standard processing optics. It encases the powder nozzle and forms a

### Contact

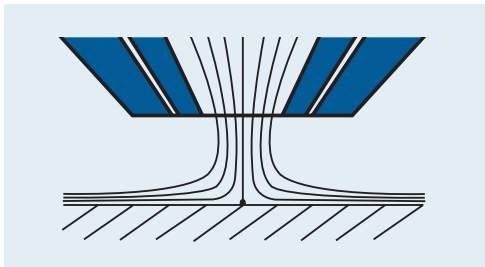
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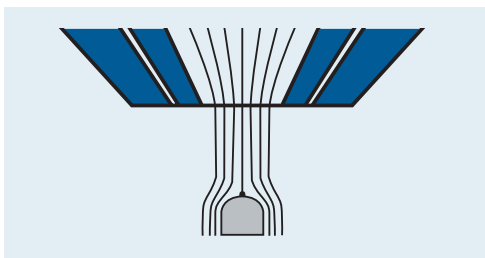
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## Demonstration of the Shielding Effect using Representative Applications for Additive Manufacturing



Production of block-shaped volumes



Manufacturing of thin bars

ring-shaped shielding gas cone around the process zone. This cone thus protects only the hot processing zone, where highly reactive materials and the ambient air can react with each other.

### 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 100 ppm within the process zone

### Applications

- Processing of reactive materials such as titanium, aluminum and refractory metals
- Large components with diameters of several meters, such as the optical bench made of titanium for the X-ray space telescope "ATHENA"
- Welding processes

Left

The new Fraunhofer IWS nozzle head "COAXshield" encases the powder nozzle and forms a ring-shaped shielding gas cone around the process zone.

Right

COAXshield offers simple but effective protection for Direct Energy Deposition.

### 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) |