POWDER FEED NOZZLE FOR THE EHLA PROCESS

Task

Conventionally, in Laser Metal Deposition (LMD), a powdered filler material is injected through a powder nozzle into the molten bath produced by the laser beam on the surface of a component and melted there. A layer is generated on the component by the laser beam as it moves relative to the component and overlap of individual tracks. The maximum process speeds are about 15 to 20 m/min. In the case of extreme high-speed laser metal deposition (German acronym EHLA), on the other hand, the powdered filler material is injected into the laser beam and melted there before the powder reaches the molten bath. This allows process speeds of several 100 m/min. Both the powder feed and powder nozzle, however, pose a particular challenge.

Method

So that the EHLA process can be used in the industry, the powder nozzle must meet the following requirements:

- Adjustable powder gas beam caustic for the optimized injection of the powder into the laser beam
- Generation of a dense powder gas jet to maximize powder efficiency
- Consistent powder gas jet quality for large flow rates > 500 kg
- Easily replaceable nozzle components after malfunctions caused by operating errors or wear

Based on the coaxial nozzle technology already existing at Fraunhofer ILT for laser metal deposition (LMD), further developments and modifications have been made for an EHLA nozzle.

Results

In order to meet the demands on the nozzle (see points 1 and 2 in Method), a freely adjustable powder gas-jet canal was developed. In combination with a protective gas stream, the powder gas stream was adapted to the laser beam caustic and, at the same time, the powder focus was optimized. By surface finishing the powder flow surfaces and by being able to quickly exchange damaged nozzle tips, Fraunhofer ILT was able to lengthen the service life of the process significantly.

Applications

The use of the EHLA process, and thus also the EHLA nozzle, is particularly suitable for applying thin, wear- and corrosion-resistant coatings on rotationally symmetrical components, for example shafts and washers for the heavy and offshore industry, e.g. as an alternative to chrome plating.

Contact

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1 Coaxial powder nozzle with interchangeable tip.

2 Coating a shaft for the offshore area.

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