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HIGHNO – HIGH quality powder NOzzle

Coaxial powder nozzle for Conventional and Extreme-High-speed Laser Material Deposition as a plug-and-play solution for series production

Depending on the application, laser material deposition uses different powder nozzles. As the lateral powder nozzles are used in hard to reach areas, the coaxial powder nozzles are direction independent and thus more suitable for integration into automated systems in coating technology and in additive manufacturing.

The coaxial powder nozzles use two tapered cones which guide the powder through a defined gap between the cones. In this way, a cone-shaped, continuous powder jet is generated around the laser. In order to realize and establish a reproducible and as small as possible powder gas jet and thus a high powder efficiency, these nozzles are manufactured with high precision and set in a time-consuming adjustment method. In this case, the nozzle tips are generally attached by threads.

If the nozzle is damaged by thermal or mechanical stress, it must be replaced. Either the entire nozzle or the lower part of the nozzle is exchanged with the corresponding two cone-shaped nozzle tips. For cost reasons, the second option is recommended. Due to manufacturing tolerances and the clearance in the thread, deviations arise (asymmetrical distribution of the powder gas jet, overspray, size and position of the powder focus, etc.) in the resulting powder gas jet after replacement. A reproducible change is achieved only partially, but a subsequent adjustment of the nozzle is often unavoidable. This leads to time-intensive interruptions in production processes, which is undesirable especially for mass production. Especially in the case of "**Extreme high-speed laser material deposition (EHLA)**" even small deviations lead to significant quality losses in the process results (small layer thickness or even bonding defects).

HD has developed a new powder nozzle in cooperation with the Fraunhofer-Institute for Laser Technology ILT, which can be used as a plug-and-play solution for series production. This new powder nozzle incorporates experience from past developments and feedback from the industry to make the powder nozzle a high-quality serial product. The so-called "HighNo - High quality powder Nozzle" is a logical further development of the patented coaxial powder nozzles by ILT. The new principle provides for a **monolithic structure** of the powder tip module, consisting of inner and outer cone. This module can be preassembled via appropriate form and position tolerances and replaced without the need for manual adjustment. Both the gap dimension and the wear resistance of the powder nozzle can be adjusted according to customer requirements. The **conversion on site** takes place in a very short time (**1-2 minutes**) without any loss of quality.

The quality of the **HighNo** powder nozzle can be measured quantitatively with the powder gas jet measuring device (ILT Patent No.: DE 10 2011 009 345 B3). Thus, **reproducible changing of the powder nozzle** within a short time in series production is no longer a wishful thinking.

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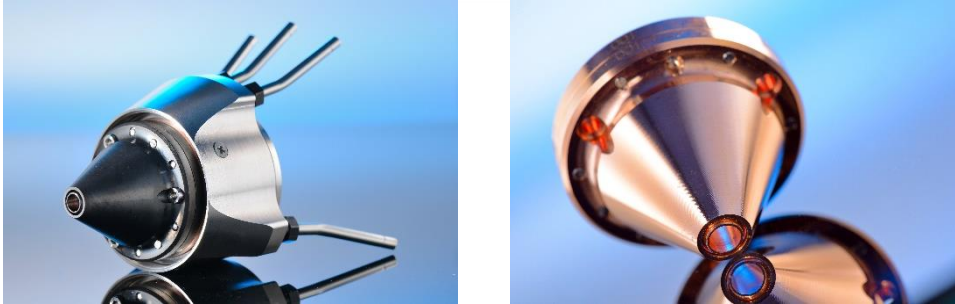


Figure 1: HighNo – Powder Nozzle (left) und Monolithic nozzle tip module (right)



Figure 1: Extreme High-speed Laser Material Deposition (EHLA) with a HighNo powder nozzle in 30°
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