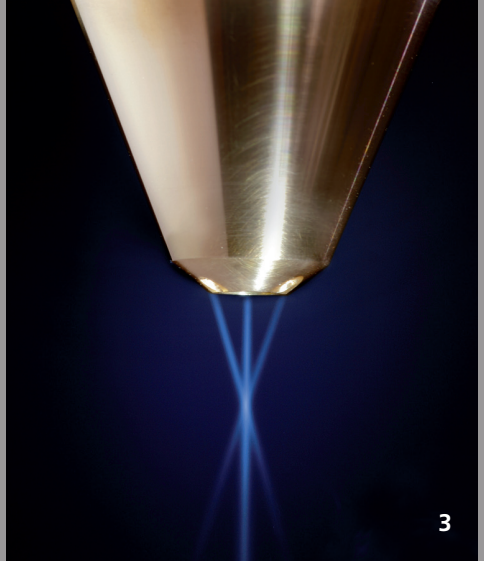

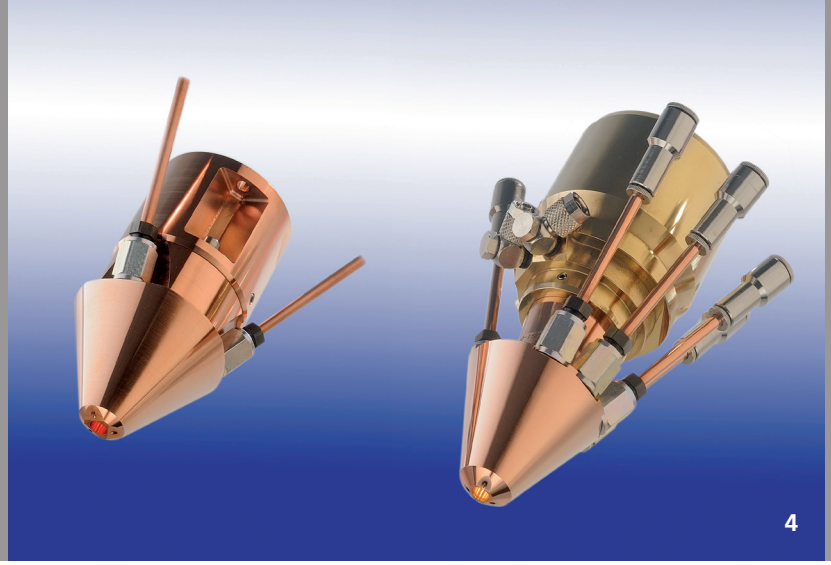

THREE-JET POWER FEED NOZZLES WITH IMPROVED PERFORMANCE

Task

An important goal of laser cladding is to increase powder efficiency. Three-jet powder nozzles are characterized by high robustness and 3D capability. Until now, however, these nozzles have reached powder efficiencies in the range of 50 - 70 percent in a powder focus of approx. 2.5 mm and a cladded track width of 2 mm. Increasing the powder efficiency, therefore, requires the development of new, improved powder feed nozzles. For laser cladding, a three-jet powder nozzle is currently being developed that generates a smaller powder focus (< 1.5 mm).

Method

Thanks to its three powder channels, the three-jet nozzle generates three individual powder jets that are brought together to form one powder focus beneath the nozzle. As part of the development of these nozzles, the powder hole diameter has been designed to be variable between 0.5 mm and 2.0 mm. The different channels are created by means of inserts made of carbide with different internal diameters. The inserts reduce, on the one hand, the wear on the powder channels caused by, e.g., abrasive powder materials, thereby increasing the stability of the nozzle. On the other hand, these inserts can easily be exchanged (in case of repair).

Result

Tests have been carried out with different powder bore diameters and the powder focus has been photographed. A comparison with the conventional three-jet powder nozzle shows three advantages: a significant reduction in the powder jet diameter from 2.5 mm to < 1.5 mm, an increase in the service life of the powder nozzles and an increase in the powder efficiency to over 80 percent on a track width of 2 mm.

Applications

Applications include the cladding of structures < 2 mm that require the powder nozzle to have 3D capability and high powder efficiency: for example, the 3D deposition of web-like structures or the repair of z-notches in turbomachinery. In addition, costs are also lower as the powder usage is reduced thanks to the improved powder feed nozzles.

Contacts

Dipl.-Ing (FH) Stefan Jung
Telephone +49 241 8906-409
stefan.jung@ilt.fraunhofer.de

Dr. Andres Gasser
Telephone +49 241 8906-209
andres.gasser@ilt.fraunhofer.de

3 Powder gas jet of the three-jet powder nozzle with inserts made of carbide.

4 Three-jet powder nozzles with inserts made of carbide.