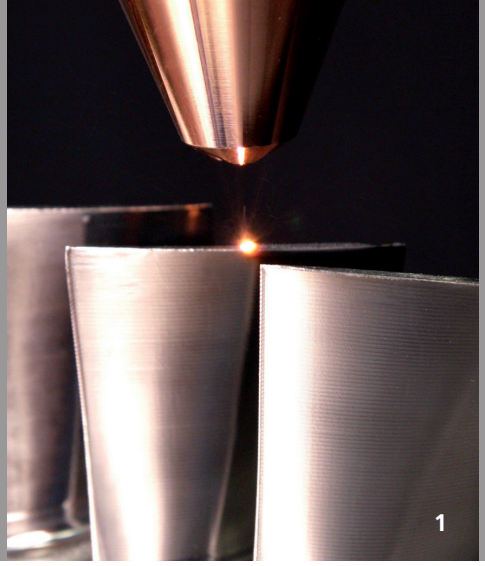

ROBOT-BASED SYSTEM TECHNOLOGY FOR LASER METAL DEPOSITION

Task

As part of the Fraunhofer Innovation Cluster AdaM (Adaptive Production for Resource Efficiency in Energy and Mobility), different process chains have been examined for the repair of turbomachinery components. Because of their low cost and the great flexibility, robotic systems are increasingly being used. In the innovation cluster, therefore, a robot-based system, consisting of a six-axis articulated robot with a tilt and turn module, has been built and tested to repair turbomachinery parts.

Method

Various components (4 kW laser, six-axis articulated arm robot, rotary-tilting module, zoom optics, powder feeder) have been combined to create a flexible robot cell. Thanks to the additional axes, the robot has a total of ten axes (6 + 1 rotary and 1 tilting, and 2 optics axes), which are controlled simultaneously via the PLC. A three-beam nozzle developed by Fraunhofer ILT has been mounted to the zoom lens, with which cladding can also be conducted in confined spaces.

Result

With this zoom lens, differently sized laser beam diameters (and, therefore, track widths) can be created, which are infinitely variable from approx. 0.2 to 2 mm, or changed during the process. Manual adjustment of the optical components is not necessary. It can perform most repairs needed in turbomachinery construction. In further studies, test samples will be cladded and an offline programming system developed by Fraunhofer ILT will be implemented.

Applications

Due to its high flexibility, the robot is principally suitable for all types of repair applications in various industries (e.g. aerospace, turbomachinery, tool construction). Since it has a greater freedom of movement than Cartesian systems, it may be of particular interest for applications where access to the processing site is severely limited.

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1 Laser Metal Deposition process by robots on blisk blades.

2 Laser-cladded blade tips.