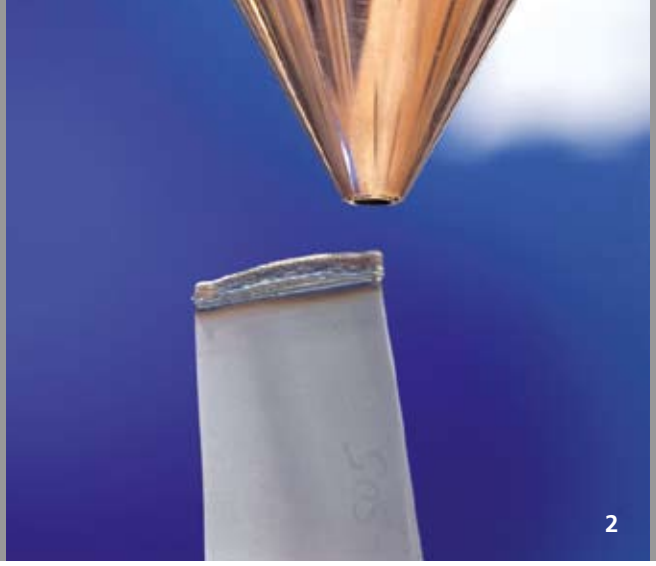

DEVELOPING A METHODOLOGY FOR CLADDING BLADE TIPS

Task

In operation, turbine and compressor blades are subject to wear that limits the operational lifetime of the component due to material removal at the blade tip. With Laser Metal Deposition (LMD), a process is available, which can build up the removed volume. The development of such an LMD-based process, however, is bound up with high experimental costs. At Fraunhofer ILT, within the scope of the Innovation Cluster »TurPro«, a methodology was developed for the LMD of blade tips, which enables similar blade tips to be repaired without additional process development.

Method

The parameter development for LA was conducted using individual tests on edges of sheet material of different widths. For this purpose, the adapted parameters have been identified for the respective sheet thicknesses. The process behavior at the leading and trailing edges has been investigated by means of high-speed camera images as well as numerical simulations. Strategies have been developed to prevent these edges from melting.

The results from the sheet material have been extracted, transferred to three sample blades out of Inconel 718 and then tested. The geometry of the blade tip was recorded by means of a laser line scanner, and a center contour track calculated on the blade tip. From this data as well as the parameters identified, an NC program has been developed in which laser power and beam diameter are adapted to the local blade width. The beam diameter during the process was adjusted using an optic from TRUMPF, which makes it possible to change the track width along the path.

Result

With the methodology developed here, LMD parameters can be transferred from sheets (of constant width) to blades and the parameter sets can be determined for the three blade types.

Applications

The methodology developed here can be transferred to a large number of blade types (aviation and energy generation) and to different materials.

With courtesy of TRUMPF Laser and Systems Technology GmbH.

Contact

Dipl.-Ing. Jochen Kittel
Telephone +49 241 8906-136
jochen.kittel@ilt.fraunhofer.de

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

1 Sample blade geometrical shapes repaired with the method developed.

2 Detail of a sample blade tip after laser cladding.

Fraunhofer Institute for Laser Technology ILT, www.ilt.fraunhofer.de
DQS certified by DIN EN ISO 9001, Reg.-No.: DE-69572-01