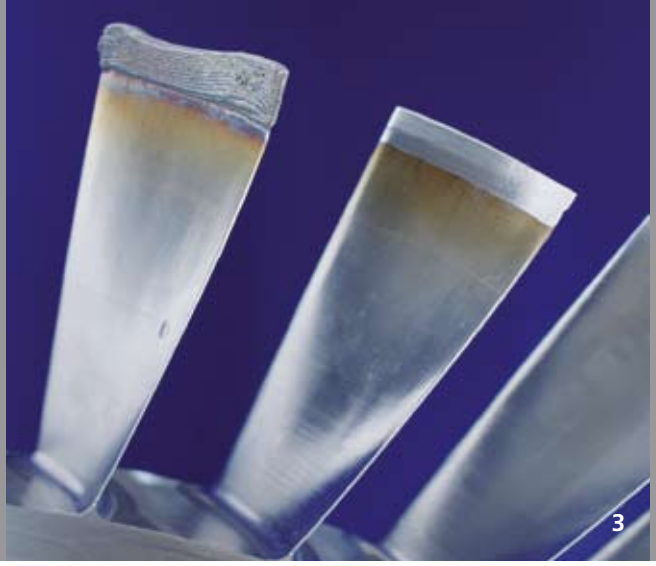

DEVELOPMENT OF A »TECHNOLOGY PROCESSOR« FOR LASER METAL DEPOSITION

Task

To develop a process for repairing blade tips with Laser Metal Deposition (LMD), the geometry and material combination (substrate and additive) have to be considered. Transferring these processes to different blade geometries with different material combinations generally requires a large amount of experimental development. To reduce this, a »technology processor« is being developed within the scope of the Fraunhofer Innovation Cluster AdaM. This processor is consisting of a data base, a simulation tool for LMD and component-specific process strategies, the latter of which only require fine tuning of the process parameters. For the data base, experimental investigations will be conducted on iron- and nickel-based alloys in various geometries. The following presents the first experimental results for the iron base material 17-4PH, exemplified using a BLISK blade tip repair.

Method

Using methods of experimental design, Fraunhofer ILT has developed process windows from which model equations have been derived. These, in turn, are used to understand the interactions between different process parameters and characteristic values for the welding bead geometries. The experimental investigations concern individual and overlapping tracks as well as the fillet geometries of different wall thicknesses. On the basis of this data base, a process window can be defined for LMD of blade geometries with locally varying wall thicknesses, with the window then only requiring fine adjustment.

Result

Thanks to this methodical approach, process parameters have been identified for LMD of BLISK blade tips, which were then cladded. The post-process machining was conducted at Fraunhofer IPT (Figure 3).

Applications

The results so far show that the methodology chosen to transfer an LMD process to other geometries and material combinations is suitable to reduce the experimental cost for this transfer. A graphic user interface is being developed so that in the future external users can also profit from this technology.

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3 Segment of a BLISK. Left: cladded BLISK blade tip. Right: machined, reworked BLISK blade tip.

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