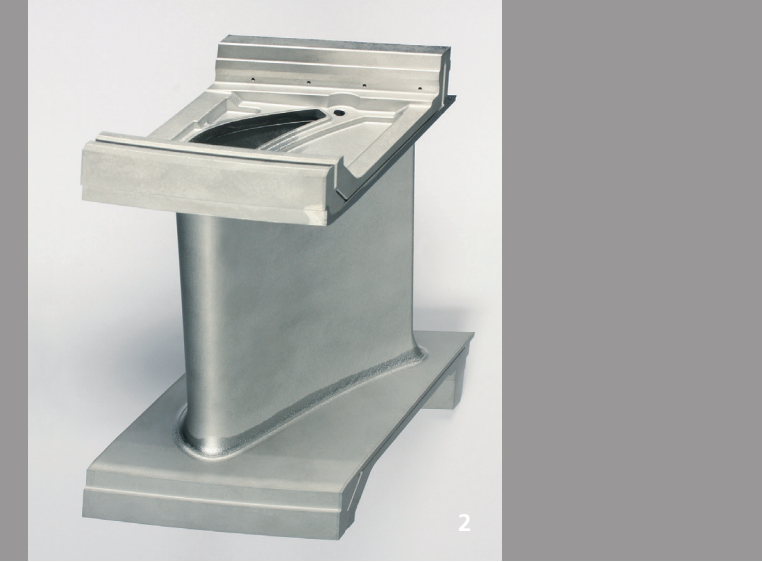


1



2

GUIDE VANE PROTOTYPES FOR PRODUCT DEVELOPMENT

Task

Turbomachinery manufacturers can profit greatly when true-to-form and near-net prototypes are made available quickly for the development of stationary gas turbine components. By promptly validating flow simulations under operating conditions or test runs of the production chain on the basis of such prototypes, development engineers can pursue different development approaches in parallel. This, in turn, can boost component performance and significantly shorten development time. As part of a bilateral project with Siemens AG, Fraunhofer ILT has investigated manufacturing guide vane prototypes with Selective Laser Melting (SLM). The project aims to create the most accurate image possible of the surfaces of blade and platforms conducting the hot gas and its internal cooling structure.

Method

The nickel-based superalloy Inconel® 718 is used to produce the guide vane prototypes with SLM because its thermo-physical properties are similar to the series material. For the production, two variants were considered: the monolithic production without (Figure 1) and the modular production in segments with a subsequent joining process (Figure 2). In both variants, the simplest possible procedure to derive defining surfaces for post-processing is considered when defining the build orientation of the components.

Guide vane out of Inconel® 718 ...

1 ... monolithically produced by SLM.

2 ... modularly prepared by high temperature brazing.

Result

The large residual stresses arising due to the component dimensions (> 200 mm) and wall thickness (> 10 mm) are accommodated both by suitable support concepts as well as an adapted component orientation. By means of the monolithic production, the hot gas conducting surfaces can be mapped, although non-removable support structures remain inside the blade. Since the blade and platforms are produced separately, the modular variant allows the most suitable orientation to be selected for the respective segments. This way, both the internal cooling structure of blades can be manufactured without supports and the hot gas conducting surfaces imaged as best possible. The segments may then be joined by means of high temperature brazing. Resulting deviations of hot gas conducting flow areas amount to approx. < 0.4 mm in both variants and, thus, meet the requirements.

Applications

The practices examined here and the results obtained can both be transferred to other components in turbomachinery as well as to other applications.

Contacts

Dipl.-Ing. Jeroen Risse
Telephone +49 241 8906-135
jeroen.risse@ilt.fraunhofer.de

Dr. Wilhelm Meiners
Telephone +49 241 8906-301
wilhelm.meiners@ilt.fraunhofer.de