



ADDITIVE MANUFACTURING OF A GUIDE VANE CLUSTER BY SLM TO TECHNICAL MATURITY

Task

The additive manufacturing process Selective Laser Melting (SLM) – also known as laser beam melting or Laser Powder Bed Fusion (LPBF) – has great potential, especially for the turbomachinery sector, since the process can manufacture components with nearly any geometrical form. In 2012, together with the project partner MAN Diesel & Turbo SE, Fraunhofer ILT identified a gas turbine guide vane cluster as a component which can be used to test SLM's ability to both increase component functionality and reduce production costs. This resulted in the task of developing and qualifying the component under design and the manufacturing aspects for additive series production.

Method

The development took place along the entire process chain. The central topics of design, SLM process as well as post-processing were continuously adapted and optimized in detail as well as to each other. In the first phase of product development, the focus was on the SLM component complying with the component requirements (mechanical properties, dimensional accuracy and surface quality).

In particular, maintaining the required surface roughness and profile tolerances in the flow channel posed a challenge for additive production. Since the blade area has limited accessibility, only tool-bound post-processing was possible. As a flow-based process was chosen to reduce the surface roughness and the additive manufacturing process was well coordinated with the surface treatment, the component requirements could be adhered to overall. In the second phase of product development, the developments were successfully transferred to two production service providers as future series suppliers.

Results

As a result of this long and intensive process, MAN Diesel & Turbo SE has approved the vane cluster for series production with SLM.

Applications

The work described here addresses the production of turbomachinery components with SLM. The methods developed for additive product development can be transferred to other sectors (e.g. the aviation industry).

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- 3 Additively manufactured MAN logo.
4 Additively manufactured guide vane cluster released for series production.