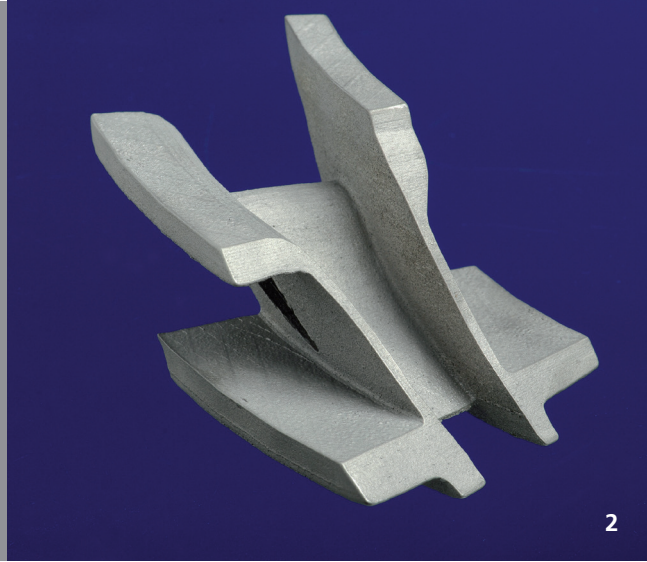


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## HIGH POWER SLM MACHINING OF INCONEL 718

### Task

The additive manufacturing process Selective Laser Melting (SLM) is primarily used for manufacturing prototypes and end products in small quantities, in accordance with the current state of the art. A significant increase in productivity is, however, required if the full potential of SLM is to be leveraged for series production and components manufactured economically in larger quantities. One way of achieving this is to use High Power Selective Laser Melting (HP SLM) in combination with tailored process control (e.g. skin/core strategy). One current example application for SLM is the manufacturing of components for test engines made out of the nickel-based alloy Inconel 718. There is still no HP SLM process control for this material.

### Method

HP SLM increases the build-up rate by using a higher laser output ( $P_L = 1$  kW). In particular with materials with relatively low thermal conductivity ( $\lambda \leq 30$  W/mK), tailored process control (skin/core principle) is used to this end. The component being created is subdivided into a skin and core area, allowing different process parameters to be assigned to each area.

In order to use this process control for IN 718, suitable process parameters must be determined for the skin area and the core area that enable a component density of approx. 100 % to be produced. The process control must also ensure a defect-free connection between the skin and core.

### Result

HP SLM machining with tailored process control (skin-core principle) enabled components to be manufactured with a density  $\geq 99.5$  % for the skin and core area as well as for the transition area between the skin and core. Hence the use of a laser output power  $P_L$  of up to 1 kW enables the build-up rate to be increased by a factor of four, compared with the conventional SLM process with  $P_L \leq 200$  W.

### Applications

At present the key SLM application for processing Inconel 718 relates to turbine manufacture. Due to increased productivity, HP SLM opens up the prospect of cost-effective series production of components in large quantities.

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1 Additive manufactured segment (front view)  
of a nozzle guide vane out of Inconel 718 (TurboMeca).

2 Back view.