Effect of thermomechanical treatments on the properties of TiAl6V4 fabricated by selective laser **melting**

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Abstract

Additive layer manufacturing such as selective laser melting (SLM) allows manufacturing complex component geometries with high precision, which are difficult or impossible to realize using conventional techniques. Titanium alloys are extensively investigated and utilized in SLM processes. In particular, TiAl6V4 alloy has a great potential and is widely used in aerospace and aeronautic industries. This study presents also the possibility of a significant reduction in the porosity of TiAl6V4 parts through the optimization of process parameters, which allows avoiding cracks and other types of localized irregularities of the parts processed by SLM. The optimized process parameters of the manufacturing of turbine blades are presented. Further thermomechanical treatment of TiAl6V4 parts such as annealing at high temperature and hot-isostatical pressing (HIP) changes the microstructure of the material and its strength and durability characteristics drastically. Hot isostatic pressing removes residual porosity and fuses unmolten particles significantly. The microstructure of the heat treated and hipped material in comparison to the non-treatment alloy and to the wrought TiAl6V4 reference material is analyzed. The effect of the thermomechanical treatments on the properties of TiAl6V4 specimens fabricated by SLM is presented and discussed. It is well known that TiAl6V4 is due to its limited temperature resistance not suitable for blades in real turbine components; its application is limited to the low pressure compressor. However, the turbine blades produced by SLM within this project are intended to firstly demonstrate the feasibility of complex structures and secondly to deliver blades for a turbine test rig which is running at moderate temperatures of 300°C and below.

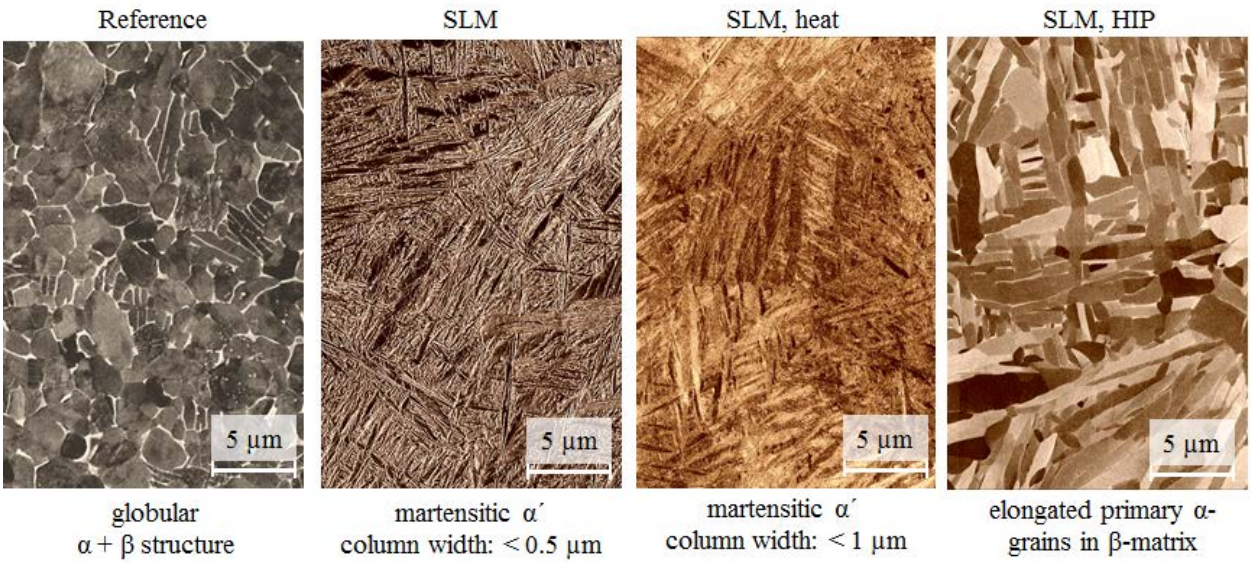

Fig. 1: Effect of thermomechanical treatment on the microstructure of TiAl6V4 fabricated by SLM.