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TA6V Selective Laser Melting as an Innovative Method Produce Complex Shapes

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Abstract : Additive manufacturing is a hot topic for industry. Among the additive techniques, Selective Laser Melting (SLM) becomes even more popular, especially for making parts for aerospace applications, thanks to its design freedom (customized and light structures) and its reduced time to market. However, some functional surfaces have to be machined to achieve small tolerances and low surface roughness to fulfill industry specifications. The complex shapes designed for SLM (ex: titanium turbine blades) necessitate the use of ball end milling operations like in the conventional process after forging. However, the metallurgical state of TA6V is very different from the one obtained usually from forging, because of the laser sintering layer by layer. So this paper aims to investigate the influence of new TA6V metallurgies produced by SLM on the machinability in ball end milling. Machinability is considered as the property of a material to obtain easily and by a cheap way a functional surface. This means, for instance, the property to limit cutting tool wear rate and to get smooth surfaces. So as to reach this objective, SLM parts have been produced and heat treated with various conditions leading to various metallurgies that are compared with a standard equiaxed α+β wrought microstructure. The machinability is analyzed by measuring surface roughness, tool wear and cutting forces for a range of cutting conditions (depth of cut 'ap', feed per tooth 'fz', spindle speed 'N') in accordance with industrial practices. This work has revealed that TA6V produced by SLM can lead to a better machinability that standard wrought alloys.

Keywords : ball milling, selective laser melting, surface roughness, titanium, wear
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