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Aljaz Ivekovic, Neda Omidvari, Bey Vrancken, Karel Lietaert, Lore Thijs, Kim Vanmeensel, Jef Vleugels, Jean-Pierre Kruth

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Aljaz Ivekovic [a], Neda Omidvari [a], Bey Vrancken [a], Karel Lietaert [a, b], Lore Thijs [b], Kim Vanmeensel [a], Jef Vleugels [a], Jean-Pierre Kruth [c]

[a] KU Leuven, Department of Materials Engineering, Kasteelpark Arenberg 44, B-3001, Heverlee, Belgium

[b] 3D Systems Leuven, Grauwmeer 14, B-3001 Leuven, Belgium

[c] KU Leuven, Department of Mechanical Engineering, Celestijnenlaan 300B, B-3001, Heverlee, Belgium

Abstract

Selective laser melting (SLM) is an additive manufacturing technique which enables fabrication of three dimensional objects by selectively melting successive layers of metallic powder. By utilizing a high energy density laser, complex geometries of even refractory metals like tungsten can be realized. However, due to its intrinsic properties (high melting point, good thermal conductivity, high ductile-to-brittle transition temperature and high surface tension) SLM of tungsten is a challenging task, mainly resulting in cracked and/or porous parts.

In order to overcome these drawbacks, the influence of the SLM processing parameters on the melting and solidification behavior of tungsten and tungsten alloys was investigated. The best results were obtained with a high energy density of the laser and lowest oxygen level in build chamber of the ProX® DMP 320, where the optimal processing conditions resulted in parts with closed porosity. Microstructural development, crack formation as well as the resulting texture in the finished parts was evaluated with respect to the material composition and the used scanning strategy.

Keywords

Selective laser melting, Direct Metal Printing, tungsten, tungsten-tantalum alloys, microstructure, texture