

2nd International Conference on

3D Printing Technology and Innovations

March 19-20, 2018 | London, UK

AlCu12 insitu alloy formation and influence of preheating bed powder on the microstructure and mechanical properties

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The significance of this work lies in its potential to create a novel dense *in-situ* aluminium (Al) alloy using Selective Laser Melting (SLM), this method would be competent for industrial applications, however the use of Al is still limited due to difficulties during the process such as fast solidification shrinkage, low absorptivity to the laser beam that promotes internal voids causing parts with high porosity giving rise to poor physical and mechanical properties. This research seeks to develop a new material based on Al-Cu to process using SLM and develop processing conditions such that the *in-situ* alloy is achieved and subsequently analyze the effect of in-process preheating on microstructure and mechanical properties. A parameter optimisation DOE was performed to determine the relationship between the factors affecting processing. High dense (95-98%) novel hypoeutectic Al-Cu were *in-situ* fabricated using SLM from pure powder mixture of Al (20-40 μ m) and Cu (10-20 μ m). The microstructural analysis shows that high temperature processed samples present a homogeneous coarser dendritic cell microstructure consisted of supersaturated Al-rich and AlCu- θ . Mechanical properties (UTS, micro-hardness) have been compared for room temperature and 400 °C degrees. The high temperature *in-situ* eutectic Al-Cu alloy present higher ultimate tensile strength and higher ductility than room temperature build sample.

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