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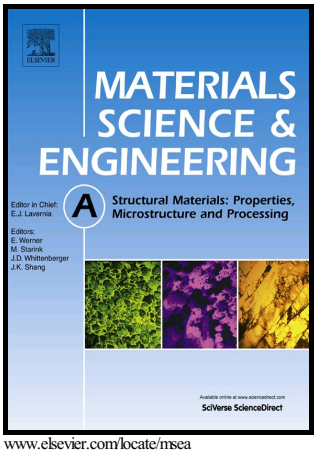

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Abstract

Many researches have been conducted on the topic of the AlSi10Mg alloy, covering different aspects of the selective laser melting fabrication process. However, a database is still lacking much information and understanding regarding the properties of the material under different conditions, which will allow a tailoring of suitable properties to the required application. This work aims to provide a correlation between the mechanical properties of vertically built (Z samples) AlSi10Mg specimens subjected to different post-processing conditions and the change in properties in relation to these conditions and the fracture mechanism. Among these is the accepted T5 stress relief treatment, a modified T5 treatment, the as-built condition and a high temperature Hot Isostatic Pressing treatment. A more in-depth analysis of the fracture mode for the vertical build direction is provided with emphasis on the mechanism for each treatment as well as a quantitative analysis of the Full Width at Half Maximum via X-Ray diffraction measurements. The modified T5 treatment suggested was found to result in an increase in strength values beyond those of the as-built condition and a 64% increase in yield stress compared to the typical T5 treatment with a concurrent decrease in elongation values. It is suggested that at 200ºC nano-scale precipitation of Silicon particles occurs, responsible for the strength elevation. Charpy impact test results are provided for each condition and their fracture mode is compared to the tensile tests and discussed.

Keywords: Additive Manufacturing, Selective Laser Melting, AlSi10Mg, Mechanical Properties, Post-processing heat treatment, Fractography