Enhancement of an additive-manufactured austenitic stainless steel by post-manufacture heat-treatment

The effect of post-manufacture heat-treatment on the mechanical strength of an additively-manufactured austenitic stainless steel has been investigated. Microstructural investigations revealed that the as-manufactured material exhibited a multi-scale structure, composed of grains, cells, dislocations and nano-sized particles. Annealing at 400°C resulted in a 10% increase in yield strength, associated with the additional precipitation of a population of nano-sized silicates. Annealing at higher temperatures resulted in a decrease in strength, attributed primarily to the thermal instability of the cell structure in the as-manufactured material. The results demonstrate that by careful control of annealing conditions the structure and mechanical properties of additively-manufactured austenitic stainless steel can be optimized by post-manufacture heat-treatment.

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