Heat Treatment of a Precipitation Hardening Aluminium Matrix Composite Processed by Additive Manufacturing

Abstract

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Additive manufacturing (AM) processing of precipitation hardening aluminium alloys is particularly challenging due to their liquation cracking sensitivity. In recent years, the addition of ceramic particles to these alloys showed significant improvements in their AM processibility. One of the Al-matrix composite which gained quite a success in commercial domain of AM is the A20X alloy, which is an Al-Cu-Mg-Ag alloy reinforced with TiB_2 particles.

Being a precipitation hardening alloy which achieves its strength by the precipitation of multiple phases, namely Al_2Cu (θ, θ' and Ω) and Al_2CuMg (S), thus optimization of the heat treatment becomes essential to reach the highest strength. In the present work, the effects of various heat treatments of A20X alloy on mechanical behaviour will be presented.

The as-built and heat-treated parts were characterized by Scanning Electron Microscopy, Transmission Electron Microscopy coupled with Energy-Dispersive X-ray spectroscopy. Phase identification was carried out through X-Ray Diffraction and their quantification was done by Rietveld refinement. The mechanical behaviour was characterized by tensile tests. In the end, the structure-property correlation of the material was established.