CAD/CAM – system for additive manufacturing

A.E. Ragulin

JSC «Delcam-m», Russia
E-mail: a.ragulin@bk.ru

Notes_____

_____

_____

_____

Effect of hot isostatic pressing and heat treatment on microstructure and mechanical properties of nickel-based alloy EP741NP fabricated by selective laser melting

Zh.A. Sentyurina[1], A.V. Mishukov[2], I.A. Logachev[1], A.I. Logacheva[1], F.A. Baskov[1]

1 - JSC Kompozit, Russia
2 - NPO Technomash, Russia
E-mail: info@kompozit-mv.ru

EP741NP is one of the most advanced Russian nickel-base superalloys used in gas-turbine engine and other applications. This alloy exhibits excellent combination of mechanical properties such as good strength, corrosion resistance, fatigue properties, oxidation resistance, and wear resistance at high temperatures.

In this work, the manufacturing of EP741NP samples using selective laser melting (SLM) technology was investigated. The precursor in the form of pre-alloyed powder produced by plasma rotating electrode process had composition Ni–16,4Co–9,4Cr–3,5Mo–5,1W–2,3Nb–1,7Ti–4,7Al–0,3Hf. Experimental specimens were produced using an EOS M290 SLM system which utilizes a Yb-fibre laser. The investigated range of laser melting parameters was as follows: laser power is 50-250 W, and the scanning speed is 0.5–1.2 m.s-1. The tensile strength of the experimental specimens ranged from 550 to 1200 MPa, depending on the SLS parameters. Maximum dense EP741NP have been fabricated at the laser power of 165 W.

The effect of hot isostatic pressing (HIP) and standard heat treatment (hardening followed by aging) on defects, microstructures and mechanical properties of SLM fabricated EP741NP samples were investigated. After each process (SLM, HIP and HT), the experimental specimens were characterized by optical microscopy, scanning electron microscopy and energy-dispersive X-ray spectroscopy to determine the microstructure and composition. The phases were extracted and identified by X-ray diffraction. Tensile testing was performed in Universal Testing machine at room temperature for as-fabricated and HIP/HT samples. Fracture surface examination was also performed by SEM.