Process Optimization of High Entropy Alloys by Laser Additive Manufacturing

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Abstract

Aerospace components and its coatings are required to possess excellent surface properties namely: fatigue, wear and corrosion resistance over a wide temperature range. Stainless steels, titanium, nickel superalloy and more recently high entropy alloys have been used to improve the exterior properties of these components. In this study, AlCoCrFeNiCu and AlTiCrFeCoNi High Entropy Alloys were successfully fabricated using laser additive manufacturing to produce coatings on a mild steel base plate. The influence of the laser parameters (laser power and scan speed) on the microstructure, hardness and coat geometry (height, width and depth) were also investigated. The results revealed that coatings homogeneously adhered to substrate. The optimum processing parameters for both alloys with defect free structures at a preheat temperature of 400 °C, were at 1200-1600 W at 8-12 mm/s with the layers composed of both FCC and BCC phases. The laser parameters affected the geometry, quality and hardness. The results showed that optimizing the laser parameters achieved by preheating temperature invariably improved the performance of the alloys with potential coatings and aerospace structural applications.

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