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Tribological and corrosion properties of laser additive manufactured AlCrFeNiCu high entropy alloy

N. Malatji [a], A.P.I. Popoola [a], T. Lengopeng [b], S. Pityana [b]

[a] Tshwane University of Technology, Pretoria 0001, South Africa
[b] Council for Scientific and Industrial Research, Pretoria 0001, South Africa

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Abstract

High entropy alloys (HEAs) are new class of materials with a high potential to find use in structural applications where high corrosion and wear resistance are required. Their high configurational entropy, sluggish diffusion, cocktail effect and ability to form stable solid solutions structures make them to exhibit unique physical and mechanical properties which are desirable for these applications. In this work, AlCrFeNiCu high entropy alloy was produced using laser metal deposition technique. The laser power was varied from 1600 to 2000 W while the scanning speed was kept constant at 13.3 mm/s. Microstructural analysis were conducted using scanning electron microscope and x-ray diffractometer. Corrosion performance of the alloy was evaluated in 0.5 M sulphuric acid solution using potentiodynamic polarization. Ball on disk tribometer was used to test for the wear resistance of the alloy. Microstructural analysis revealed that the alloy exhibited a dendritic microstructure consisting of dual phase (bcc + fcc) solid solutions. The wear resistance of the alloy decreased with the increase in laser power. The worn out surfaces showed that the nature of wear was adhesive. However, no relationship between laser power and corrosion resistance of the samples was established.