Effect of Nb addition on the microstructural, mechanical and electrochemical characteristics of AlCrFeNiCu high-entropy alloy

N. Malatji

A. P. I. Popoola

T. Lengopeng

S. Pityana

International Journal of Minerals, Metallurgy and Materials, volume 27: 1332–1340

Free fulltext nonprint link: https://rdcu.be/b9rg6

ABSTRACT:

$AlCrFeNiCuNb_x$ (x = 0.05, 0.15, and 0.26) high-entropy alloys (HEAs) were successfully fabricated using the laser metal deposition technique. The laser power of 1600 W and scanning speed of 1.2 m/min were used during laser processing of the alloys. The microstructural, mechanical, and electrochemical characteristics of the alloys were evaluated using various advanced characterization techniques. Results showed that the alloys exhibited a dual-phase structure with dendritic grains. The inclusion of Nb in the AlCrFeNiCu alloy matrix promoted the formation of fine eutectic structures and changed the shape of the grains from columnar to equiaxed. The Cu content decreased with the increase in the content of Nb, whereas the Al content increased with the increase in the content of Nb. The findings indicated that the presence of Nb in the alloy promoted the formation and enhanced the stability of the body-centered cubic (bcc) phase. All of the alloys that contained Nb also exhibited high hardness, compressive strength, and wear resistance. Furthermore, the low current density and positive shift in potential exhibited by HEAs with appropriate addition of Nb highlighted the superior anticorrosive properties.