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Electrical resistivity and oxidation behavior of Cu and Ti doped laser deposited high entropy alloys

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Abstract

In this study, AlCoCrFeNi–Cu (Cu-based) and AlCoCrFeNi–Ti (Ti-based) high entropy alloys (HEAs) were fabricated using a direct blown powder technique via laser additive manufacturing on an A301 steel baseplate for aerospace applications. The purpose of this research is to investigate the electrical resistivity and oxidation behavior of the as-built copper (Cu)- and titanium (Ti)-based alloys and to understand the alloying effect, the HEAs core effects and the influence of laser parameters on the physical properties of the alloys. Design/methodology/approach. The as-received AlCoCrFeNiCu and AlCoCrFeNiTi powders were used to fabricate HEA clads on an A301 steel baseplate preheated at 400°C using a 3 kW Rofin Sinar dY044 continuous-wave laser-deposition system fitted with a KUKA robotic arm. The deposits were sectioned using an electric cutting machine and prepared by standard metallographic methods to investigate the electrical and oxidation properties of the alloys. Findings. The results showed that the laser power had the most influence on the physical properties of the alloys. The Ti-based alloy had better resistivity than the Cu-based alloy, whereas the Cu-based alloy had better oxidation residence than the Ti-based alloy which attributed to the compositional alloying effect (Cu, aluminum and nickel) and the orderliness of the lattice, which is significantly associated with the electron transportation; consequently, the more distorted the lattice, the easier the transportation of electrons and the better the properties of the HEAs.