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PROCEEDINGS

In-Situ Carbide-Reinforced NiCoCr Medium-Entropy Alloy Manufactured by Laser Powder Bed Fusion; Fabrication, Microstructure, Mechanical Property, and High Temperature Oxidation Behavior

Kee-Ahn Lee[1,*], So-Yeon Park[1], Soo-Bin Kim[1] and Young-Kyun Kim[1,2]

[1]Department of Materials Science and Engineering, Inha University, Incheon, 22212, Korea
[2]Korea Institute of Materials Science, Changwon, 51508, Korea
[*]Corresponding Author: Kee-Ahn Lee. Email: keeahn@inha.ac.kr

ABSTRACT

NiCoCr medium-entropy alloys (MEAs) with controlled interstitial C contents were fabricated by using powder bed fusion-type additive manufacturing (AM) process. And the microstructure, mechanical properties, and high temperature oxidation resistance of in-situ carbide-reinforced NiCoCr Medium alloy were investigated. The initial microstructure shows that both AM-built interstitial C-doped MEAs had a heterogeneous grain structure and epitaxial growth grains along the building direction. The analysis of electron channeling contrast images showed a large amount of nano-sized precipitates (in-situ precipitates) distributed at the sub-structure boundaries formed by a dislocation network, and a large number of stacking faults were simultaneously observed inside the sub-structure. A room temperature tensile tests indicated the highest properties among additively manufactured MEAs reported to date. After heat treatment process, the size and ratio of nano-sized precipitates enhanced and identified as Cr-rich $M_{23}C_6$ carbide. The yield and tensile strengths increase after heat treatment, which is attributed to the prevailing solid solution strengthening and precipitation strengthening. In the C-dopped MEA fabricated by L-PBF, Cr-rich $M_{23}C_6$ is formed along the sub-grain boundaries, and carbide oxidation occurs due to high temperature oxidation exposure. Based on the above results, the deformation and high temperature oxidation mechanisms of AM-built interstitial NiCoCr MEA were also discussed.

KEYWORDS

Medium entropy alloy; NiCoCr; carbon content; microstructure; mechanical property; high temperature oxidation

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