77th IIW Annual Assembly and International Conference on Welding and Joining
7-12 July 2024
Rhodes, Greece

OP 172

Microstructure evolution of Ni-Co-Al alloy by laser directed energy deposition

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Understanding the formation mechanism of microstructure of Ni-Co-Al base alloy fabricated by Laser Directed Energy Deposition (LDED) is of great importance to promote its development and application in advanced aeroengine field. The content of Al element plays an important role in the solidification structure of Ni-Co-Al alloy, which is the main element of γ' and β phase for strength the alloy. In this study, Ni-Co-Al alloy samples with different Al contents were prepared by LDED and their microstructure was characterized. With the change of Al content, the as-deposited microstructure of Ni-Co-Al alloy changes significantly. When the content of Al is low, the columnar grains of all γ-dendrites appears. With the increase of Al content, γ-β eutectic phase appears at the grain boundaries of the columnar grains and the interdendritic area. When the Al content reaches 21at%, the structure becomes full gamma-β eutectic. When the content of Al is higher than 21at%, the primary phase becomes β dendrite, and the interdendritic area is γ-β eutectic phase. The microhardness of γ phase increases with the increases of Al content.