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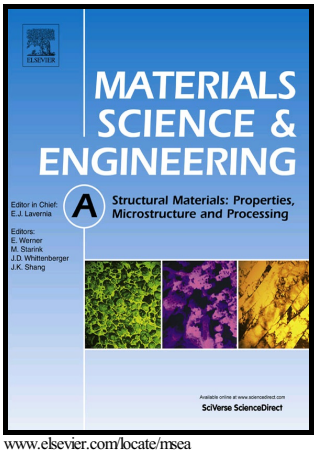

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Jun Wang, Zengxi Pan*, Yan Ma, Yao Lu, Chen Shen, Dominic Cuiuri, Huijun Li

School of Mechanical, Materials, Mechatronic and Biomedical Engineering, University of Wollongong, Northfield Avenue, Wollongong NSW 2522, Australia

ABSTRACT

In this paper, titanium-aluminide functionally graded material with a designed composition range from pure Ti to Ti-50 at% Al is successfully fabricated using the double-wire arc additive manufacturing method (WAAM). Due to the influence of Al concentration, the morphology, microstructure, mechanical properties and oxidation behaviour vary greatly along the gradient direction of the manufactured bulk. With increasing Al content from the bottom to the top, the bulk exhibits a layered structure consisting of α–β duplex structure, α-α_2 lamellar structure, large α_2 grains, α_2-γ duplex lamellar structure and γ interdendrities structure in sequence from the bottom to the top. Microhardness and tensile strength exhibit similar trends and are comparable to those of mono-composition components. The oxidation resistance degrades at an increasing rate with decreasing Al content due to oxide breakaway occurring in the TiAl alloy matrix that consists of single α_2 or α_2+α. The experimental results indicate that the WAAM method is able to produce defect free TiAl functionally graded material with the desired composition gradient, suitable mechanical properties and acceptable oxidation behaviour.

Key words:

Titanium aluminide functionally graded material, wire arc additive manufacturing, microstructure, mechanical properties, oxidation behaviour.