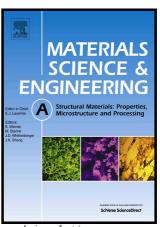
## Author's Accepted Manuscript

Characterization additively of wire arc functionally manufactured titanium aluminide mechanical graded material: Microstructure, properties and oxidation behaviour

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### ACCEPTED MANUSCRIPT

# Characterization of wire arc additively manufactured titanium aluminide functionally graded material: Microstructure, mechanical properties and oxidation behaviour

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### **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  $\alpha$ - $\beta$  duplex structure,  $\alpha$ - $\alpha$ <sub>2</sub> lamellar structure, large  $\alpha$ <sub>2</sub> grains,  $\alpha$ <sub>2</sub>- $\gamma$  duplex lamellar structure and  $\gamma$  interdendrities structure in sequence from the bottom to the top. Microhardness and tensile strength exhibit similar trends and are comparable to those of monocomposition 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  $\alpha$ <sub>2</sub> or  $\alpha$ <sub>2</sub>+ $\alpha$ . 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.

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