Surface Review and Letters

A study on scan speed relationship with microstructural evolution, phase composition and microhardness of Ni-containing intermetallic coatings on Ti–6Al–4V using cladding technique

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Abstract

Titanium alloys have been used for variety of engineering applications but their relatively low hardness and low thermal conductivity are shortcomings that have reduced their potential use. In this work, attempts have been made to study the effects of laser scanning speed and admixed fraction of reinforced Ni–Co powders on clad layer formation and its corresponding properties on Ti–6Al–4V. Laser power of 750W, beam size of 3mm with argon shield gas flow rate of 1.2L/min was made constant, while the powders were premixed and deposited on Ti–6Al–4V with varying compositions at different scanning speeds of 0.6 and 1.2m/min. The microstructural analysis, phase constituents and hardness properties of Ni–Co intermetallics reinforced clads were also examined. The morphology of the resultant coatings was analyzed using X-ray diffractometry (XRD) and scanning electron microscopy (SEM) equipped with energy dispersive spectrometry (EDS). The research results showed that laser cladding coatings displayed enhanced properties such as fine microstructure and good metallurgical bonding with the substrate containing minimal pores with respect to the substrate. Furthermore, the microstructure revealed the formation of various fractions of interdendritic compounds/intermetallics dispersed within the coating matrix which could be responsible for the increased hardness obtained. The average hardness of the coating was about 856HV 0.1, which was about 2.5 times that of the substrate.