

Materials Design and Applications V

Characterisation of additive manufactured Ti6Al4V-W–Ni composite

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Abstract

Excellent properties of titanium alloy grade V make this alloy a material of choice in aerospace industry and other industries such as biomedical and medical industries. The most attractive of these properties for the aerospace industry is the high-strength-to-weight ratio. The need for advanced materials that are designed to produce a set of properties that cannot be seen in a single material is constantly needed in various engineering applications. Additive manufacturing (Am) technology is central to achieving this goal because of the possibility of producing any component using the desired material in a single manufacturing run and as a single component no matter the complexity of the part. In this study, the microstructural evolution and mechanical property of Ti6Al4V-W–Ni composite produced through laser metal deposition, an additive manufacturing technology, was investigated. Elemental powder of nickel and tungsten powder were deposited on titanium alloy grade V substrate by varying the laser scanning speed from 0.12 m/mm to 0.48 m/min, while keeping all other processing parameters constant. The effect of scanning speed on the evolved microstructure and microhardness were studied. Functionally gradient microstructures were observed in all the samples with varying microhardness values. As the scanning speed was reduced, high microhardness was observed. All samples produced have higher microhardness values than the substrate material. Samples produced at a scanning speed of 0.3 m/min has the highest average microhardness value of 491.8. This study revealed that AM can be used to produce complex part with designed material properties in a single manufacturing run.