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Scanning velocity influence on microstructure, microhardness and wear resistance performance of laser deposited Ti6Al4V/TiC composite

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Abstract

Ti6Al4V is the most widely used titanium alloy in the aerospace industry because of its excellent properties. However, the wear resistance behaviour of this material is not very impressive and surface damage occurs in applications involving contact loadings. Laser material deposition process, an additive manufacturing technology offers lots of advantages in surface modification of components, repair of existing worn out parts, as well as building new components from the scratch, most especially complex components. A good control of the process parameters is inevitable to achieve the desired properties. It is easier to control a single process parameter to achieve the desired property than to control a number of the processing parameters. In this study, the influence of the scanning velocity on the evolving physical properties, the microstructure, the microhardness and the wear resistance behaviour of Ti6Al4V/TiC composite is thoroughly investigated towards achieving an effective properties control. The results showed that controlling only the scanning velocity, the physical, mechanical, metallurgical and the tribological properties of the Ti6Al4V/TiC composite can be effectively controlled. It was found that as the scanning velocity was increased, the wear resistance performance also increased, until the scanning velocity of 0.065 m/s, after which the wear resistance performance began to experience a decrease. At low scanning velocity, there were less Unmelted Carbide particles in the microstructure due to more melting of the TiC powder taking place, hence the low wear resistance performance obtained.