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Laser Surface Cladding of Ti-6Al-4V on AISI 316L Stainless Steel for Bio-implant Application

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The present study concerns an in-depth investigation of the influence of laser surface cladding of Ti-6Al-4V on the microstructure (both the top surface, cross-section and interface), wear resistance, corrosion resistance and bio-activity of AISI 316L stainless steel. Laser surface cladding has been carried out using a 5 kW continuous wave (CW) fibber optics delivery Nd: YAG laser with a beam diameter of 4 mm. Microstructure of the surface clad layer consists of acicular a' -phase and the microstructure of the interface consists of equiaxed grains of a-phase and white precipitates of FeTi intermetallic phase at the grain boundaries. The average microhardness of the clad zone and the interface increases to 240 and 531 VHN, respectively as compared to 220 VHN for as-received AISI 316L stainless steel. Fretting wear behaviour against hardened steel ball showed a marginal improvement in fretting wear resistance due to laser surface cladding. On the other hand, the wear resistance of the interface increases significantly. An improvement in corrosion resistance with improved bio-activity is also noticed due to laser surface cladding.

Keywords: Nd:YAG laser, laser surface cladding, Ti-6Al-4V, AISI 316L stainless steel, microstructure, hardness, wear