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Effects of niobium (Nb) on mechanical properties of laser coated nitinol (NiTi) used for surface modification of Ti6Al4V alloy

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Abstract

In the present study, mechanically pre-alloyed powders consisting of niobium, titanium and nickel were deposited onto Ti6Al4V substrates to form a coating with the aim of improving surface wear resistance. Laser cladding was used to melt the injected powder to form a coating on the surface of the substrate. Fabricated samples were produced from the powder mixture of $Ti_{55}Ni_{45}$, $Ti_{53.75}Ni_{43.75}Nb_{2.5}$, $Ti_{52.5}Ni_{42.5}Nb_5$ and $Ti_{51.25}Ni_{41.25}Nb_{7.5}$ using different laser power (600W and 1000W) and laser-scanning speed (0.5-1m/min) at fixed powder deposition rate of 2rev/min. The fabricated samples were characterised using optical microscopy (OM), scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS), differential scanning calorimeter (DSC), X-ray diffraction (XRD), micro hardness tester and wear tester. The produced coatings were well bonded and consisted of globular and dendritic structure with intermetallic phases such as NiTi and $NiTi_2$. Hardness decreased with an increase in niobium content while wear resistance enhanced, with no cracking on the coating surface as niobium content increased