

Enhancement of wear and corrosion resistance of beta titanium alloy by laser gas alloying with nitrogen - DTU Orbit (08/11/2017)

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The relatively high elastic modulus coupled with the presence of toxic vanadium (V) in Ti6Al4V alloy has long been a concern in orthopaedic applications. To solve the problem, a variety of non-toxic and low modulus beta-titanium (beta-Ti) alloys have been developed. Among the beta-Ti alloy family, the quaternary Ti-Nb-Zr-Ta (TNZT) alloys have received the highest attention as a promising replacement for Ti6Al4V due to their lower elastic modulus and outstanding long term stability against corrosion in biological environments. However, the inferior wear resistance of TNZT is still a problem that must be resolved before commercialising in the orthopaedic market. In this work, a newly developed laser surface treatment technique was employed to improve the surface properties of Ti-35.3Nb-7.3Zr-5.7Ta alloy. The surface structure and composition of the laser-treated TNZT surface were examined by grazing incidence X-ray diffraction (GI-XRD) and X-ray photoelectron spectroscopy (XPS). The wear and corrosion resistance were evaluated by pin-on-plate sliding test and anodic polarisation test in Hanks' solution. The experimental results were compared with the untreated (or base) TNZT material. The research findings showed that the laser surface treatment technique reported in this work can effectively improve the wear and corrosion resistance of TNZT.

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