

Effects of plasma nitriding on Ti-6Al-4V ELI biomedical material

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Titanium and titanium alloys are widely used in biomedical devices and components. Ti-6Al-4V ELI is mostly used for cardiovascular, dental, orthopaedic and spinal implants. This alloy has good biocompatibility, formability, machinability and corrosion resistance, but low hardness and wear resistance. Therefore, surface modification is necessary [1].

Plasma nitriding is a thermochemical surface treatment which can improve the hardness and wear resistance of the surface. Nitrogen diffusion hardening creates $\text{TiN} + \text{Ti}_2\text{N} + \alpha\text{Ti(N)}$ in the top layer of the material and leads to an increased surface roughness [2-3]. The cell viability after 5 days is also better on the nitrided titanium alloy, so the biocompatibility can be increased with the treatment [4]. However, the nitriding parameters for titanium are not well defined, and direct current plasma nitriding (DCPN) can cause irregularity on the surface.

The aim of this study is to examine the effects of plasma nitriding with surface evaluation and corrosion measurements. In this experiment $\varnothing 20 \times 6$ mm sized Ti-6Al-4V ELI disks were treated by various plasma nitriding methods (direct current plasma nitriding (DCPN) and active screen plasma nitriding (ASPN)). Surface hardness was measured before and after nitriding. The treated samples were cut in half for cross section examination with scanning electron microscope (Figure 1). The corrosion rate of the material is determined by potentiodynamic measurements with a potentiostat.

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