2nd Nanotube Formed Surface Observation of the Ti-25Ta-xZr Alloys Using ATO Technique

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Abstract: The purpose of this study was to investigate 2nd nanotube formed surface observation of the Ti-25Ta-xZr alloys using ATO(anodic titanium oxide) technique. Ti-25Ta-xZr alloy was anodized in 1M H_3PO_4 electrolytes containing 0.8 Wt. % NaF at room temperature. After formation of nanotube was achieved out, nanotube was eliminated, and then anodization was carried out repeatedly. The microstructures, phase transformation, and morphology of nanotubular Ti-25Ta-xZr alloys and process of nanotube growth by using ATO method was examined by optical microscopy (OM), X-ray diffraction (XRD), and field emission scanning electron microscopy (FE-SEM). The α phase and β phases were affected to form the second nanotube morphology of Ti-25Ta-xZr alloys.

1. Introduction

The conventional implant materials such as stainless steels, Co-Cr alloys, Ti and its alloys have been widely used in the medical field for many years. However, these materials can potentially cause some health problems because of the release of toxic metal ions. For improving this problem, many Ti alloys consisting of non-toxic elements such as Ta, Nb, Zr, Hf have been developed for use in biomedical applications. Titanium alloys with Ta and Zr show potential for dental alloys. The addition of Zr to Ti alloy results in excellenct mechanical properties, good corrosion resistance, and biocompatibility. Especially, the addition of Zr to Ti alloy results in high level of blood compatibility when used in cardiovascular implants and leads to better corrosion resistance due to the formation of stable ZrO_2, also, Ta element to Ti shows low elastic modulus that can be obtained since these elements are β-stabilizer. Among the surface modification methods for dental implant application, nanotube dioxide formation on these alloy surfaces is significant to enhance cell adhesion and proliferation. And the nanotubular surface with nano-scale on the native oxide will result in very strong reinforcement of the bone response. Hence, it is needed to investigate the phenomena of nanotube nucleation and growth by anodic titanium oxide (ATO). ATO technique is currently employed to fabricate the regular and aligned nanoarrays.

2. Experimental

ATO method was used for identification of nanotube formation on the α+β phase. Formation of nanotubular structure was achived by an electrochemical method in 1M H_3PO_4 containing 0.8 wt. % NaF electrolyte for 1 hour at 30V. After 1st formation of nanotube was achieved, nanotube layer was eliminated, and then anodization was carried out in same solution repeatedly. The microstructure, phase transformation, morphology of nanotubular Ti-25Ta-xZr alloys and process of nanotube growth by using ATO method was analyzed by optical microscopy (OM), X-ray diffractometer (XRD), field emission scannig electron microscopy (FE-SEM), energy dispersive X-ray spectroscopy (EDX).

3. Conclusion

The α phase and β phases were affected to form the second nanotube morphology of Ti-25Ta-xZr alloys.

References

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