Nanotube Morphology Control of Ti-30Nb-xTa Alloys by Applied Voltages

Eun-Sil Kim*, Han-Cheol Choe
*Department of Dental Materials, Research Center of Nano-Interface Activation for Biomaterials, & Research Center for Oral Disease Regulation of the Aged, School of Dentistry, Chosun University, Gwangju, Korea
(E-mail: hcchoe@chosun.ac.kr)

Abstract: This study has investigated the nanotube morphology control of Ti-30Nb-xTa alloys by applied voltages. The morphology changed from small diameter to large diameter with increasing applied voltage, whereas, changed from large diameter to small diameter with decreasing applied voltage.

1. Introduction

Recently, β-type titanium alloys like a Ti-Nb-Ta are promising candidates for serving as bio-implant materials of bone and teeth, because they have superior biocompatibility, higher specific strength and greater working properties in comparison with other metallic implant materials being in use nowadays. To improve bone tissue integration, various techniques have been used to increase the roughness of implant surface. Nanotube size is important in cell proliferation and adhesion. Also, optimized parameters such as anodization potential, nature of the electrolyte, concentration of the electrolyte, temperature, and the potential sweep rate are critical in achieving self-ordered nanotubes. The thickness of the nanotube layers increased with anodizing potential and anodization time.

In this study, the nanotube morphology control of Ti-30Nb-xTa alloys by applied voltages was researched.

2. Experimental

The Ti-30Nb-xTa alloys with Ta contents of 0, 15 wt. % were melted by using a vacuum arc-melting furnace and, homogenized for 12h at 1000℃. This study was evaluated the phase of Ti-30Nb-xTa alloys using an x-ray diffractometer (XRD), and the microstructure of the samples was investigated with field emission scanning electron microscopy (FE-SEM) and optical microscope (OM). The anodization was performed by changing of applied voltage from high to low (30 V to 10 V) and, from low to high (10 V to 30 V) for 1h. The electrolyte was composed of 1 M H_3PO_4+ 0.8 wt.% NaF. Nanotube morphology was observed using XRD, FE-SEM and EDS.

3. Conclusion

The morphology changed from small diameter to large diameter with increasing applied voltage, whereas, changed from large diameter to small diameter with decreasing applied voltage.

References

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