Nanotube Shape Changes on Ti-30Nb-xTa Alloys with Continuously Changed Potentials

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Abstract

CP-Ti and its alloys have over the past few decades become the premier choice as biocompatible dental and hip replacement implant materials. Although the Ti-6Al-4V alloy is an acceptable prosthetic biomaterial, recent studies indicated that the release and accumulation of Al and V ions could have harmful effects on the human body. In order to overcome these disadvantages of Ti-6Al-4V alloy, new β type Ti alloy made of non-toxic alloying elements such as Nb, Ta and Zr have been developed. Surface modification is generally essential to improve the chemical bonding between Ti implant and bone tissues. Thus, it has been shown that nano-scale porous as well as tubular oxide layers on titanium alloys can increase the bioactivity of an implant material. Also, it should be possible to control the nanotube size and morphology for biomedical implant use by controlling the applied voltage, alloying element, current density, anodization time and electrolyte. The aim of this study was surface modification of nanotube formed Ti-30Nb-xTa alloys with changes in anodization factors. 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℃. 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. 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). For biocompatibility, fibroblast cell was cultured and contact angle was measured. (NRF: No.2008-0062283; hcchoe@chosun.ac.kr).

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