Morphology Observation of Nanostructured Ti-25Ta-xZr Alloys

Hyun-ju Kim, Yeong-Mu Ko, 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
(hcchoe@chosun.ac.kr)

Abstract: In this study, we investigated morphology observation of nanostructured Ti-25Ta-xZr alloys. Ti-25Ta-(3 wt%~15 wt%) Zr alloys were prepared by a vacuum arc-melting furnace. Formation of nanotubular structure was achieved by an electrochemical method in 1M H_3PO_4 electrolytes containing 0.8%wt.% NaF. Nanotube morphology depended on alloying elements.

1. Introduction

Titanium alloys are widely used for dental implant and orthodontic surgery application because of their excellent corrosion resistance and biocompatibility. however, there are certain disadvantages such as poor osteointegration ptoperties, high elastic modulus, and low corrosive-wear resistance. For improving this problem, some researchers have focused on Ti-Ta-Zr alloy system with controlling the contents of Ta and Zr elements. When added to Ti, Ta acts as a β-phase stabilizer and lowers the elastic modulus, and The addition of Zr also results in a high level of blood compatibility when used in cardiovascular implants and leads to better corrosion resistance due to the formation of stable ZrO_2.

The nanotubular surface with nano-scale on the native oxide will result in very strong reinforcement of the bone response. For the formation of nanoscale surface, self-organized nanotubular TiO_2 has been produced in fluoride-containing electrolytes such as HF electrolytes, chromic acid-HF mixtures, $(NH_4)_2SO_4$-NH_4F mixtures, H_2SO_4-HF mixtures and H_3PO_4-NaF mixtures. It should be possible to control the nanotube size and morphology for biomedical implant surface by controlling the applied voltage, alloying element, and time.

In this study, we investigated morphology observation of nanostructured Ti-25Ta-xZr alloys by FE-SEM.

2. Experimental

Ti-25Ta-(3 wt%~15 wt%) Zr alloys were melted by using a vacuum arc-melting furnace. Ti-25Ta-xZr alloys were homogenized for 12hr at 1000℃ and then water quenching. Formation of nanotubular structure was achieved by an electrochemical method in 1M H_3PO_4 electrolytes containing 0.8%wt.% NaF. The microstructures, phase transformation, and morphology of nanotubular Ti-25Ta-xZr alloys were analyzed by OM, XRD, DSC and FE-SEM

3. Conclusions

Nanotube morphology depended on alloying elements.

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