Mn-doped Hydroxyapatite Formation on Nanotube Structured Ti-35Ta-xNb Alloys

Chae-Ik Jo, Seon-Yeong Park, 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

*corresponding author : hcchoe@chosun.ac.kr

CP Ti and Ti-6Al-4V alloy was widely used in biomedical applications, however CP Ti and Ti-6Al-4V alloy were difference human bone and Ti-6Al-4V alloy can influence on human body due to vanadium and aluminum. For this reason, we need to new Ti alloy with high corrosion resistance similar to Ti-6Al-4V alloy. The new Ti alloys were known as typical β-type alloy, β-type Ti alloys were composed of non-toxic and harmless elements. Also, this alloy can control decreasing the mechanical characteristics such as Young's modulus. To enhanced biocompatibilities, electrochemical anodic oxidation is known to excellent method in the biocompatibility of biomaterials. The anodizing oxide layer and diameter modulation of Ti alloys can be obtained function of improvement of cell adhesion. Hydroxyapatite was widely known as being osteo-conductive, and was able to promote bone in-growth and attachment to the surface of the implant during the early stages of the implantation. The Mn^{2+} ion increases the ligand-binding affinity of integrins through conformational changes. The integrins are a quite large family of receptors, which mediate cellular interactions with extra-cellular matrix, and activate cell adhesion.

In this study, we carried out experiment to obtain Mn-doped hydroxyapatite formation on nanotube structured Ti-35Ta-xNb Alloys. This alloys were manufactured on the base of Ti with 35 wt. % Ta and Nb which contents of 0, 5, 10, 15 wt. %. The homogenization was performed for 12 h at 1000 ° C and water quenched at 0℃. The sample was embedded in epoxy resin, leaving a square surface area of 1 cm^2 exposed to the anodizing electrolyte of 1 M H_3PO_4 containing 1.2 wt. % NaF and first sweeping the potential from the open-circuit potential to the desired final potential at a sweep rate of 500 mV/s then the potential was held at this final level for 1 h. Electrochemical deposition was carried out using cyclic and voltammetry (CV) method at 85 ° C in 4.95 mM $Ca(NO_3)_2 \cdot 4\ H_2O$ + 3 mM $NH_4H_2PO_4$ + 0.05 mM $Mn(NO_3)_2 \cdot 4\ H_2O$. Microstructures of the alloys were examined by OM and FE-SEM, and XRD was employed to identify the phases in the Ti-35Ta-xNb alloys. The morphology of the nanotube and HA precipitation was characterized by FE-SEM. (Supported by NRF: 2013 R1A1A 2006203; hcchoe@chosun.ac.kr).