Precipitation Behaviors of Hydroxyapatite on Highly Ordered Nanotubular Ti-35Ta-xNb Alloy Surface

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Abstract : In this study, precipitation behaviors of hydroxyapatite on highly ordered nanotubular Ti-35Ta-xNb alloy surface were researched. Ta and Nb additions to Ti increased corrosion resistance. The surface characteristics of anodized alloy depended on the nanotube formed voltage and alloy element. The HA precipitation morphology was influenced by nanorubular structure of alloys.

1. Introduction

Ti and its alloy were widely used for dental implant applications due to their high strength, and high level of biocompatibility. However Ti-6Al-4V alloy can influence on human body due to vanadium and aluminum. For this reason, we need to develop the new Ti-based biomaterial non-toxic and non allergic element such as Nb, Ta, Zr, Hf, and Mo. The β phase Ti alloy exhibiting excellent cold workability and martensitic transformation temperature above 373 ℃ can be achieved by adjusting the amount of β stabilizing element such as Mo, Nb and Ta. To improve biocompatibility, various surface treatment have been used to increase the surface roughness of implant surface. Nanotube formation on the Ti alloy surface was important in cell proliferation and adhesion. Hydroxyapatite was widely used in biomaterial to repair bone substitution, and as a coating material for material for metallic implant. Hydroxyapatite can improve bonding between body tissue and metal implant surface.

In this study, precipitation behaviors of hydroxyapatite on highly ordered nanotubular Ti-35Ta-xNb alloy surface were researched.

2. Experimental

This alloys were manufactured Ti with 35 wt% and Nb which contents of 0, 5, 10, 15 Wt% in arc-melting furnace and homogenization was performed at 12 h at 1000 ℃ in Ar atmosphere and 0 ℃ water quenching. Anodizing treatments were using a conventional two-electrode configuration with a platinum counter electrode and a saturated calomel reference electrode. The sample was covered in formica, leaving a square surface area of 1 cm^2 exposed to the anodizing electrolyte of 1 M H_3PO_4 containing 1.0 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. HA precipitation was carred out using cyclic and voltammetry (CV) method at 80 ℃ in 5 mM $Ca(NO_3)_2$ + 3 mM $NH_4H_2PO_4$. Microstructure of the alloys were examined by optical microscopy (OM) and field emission scanning electron microscopy (FE-SEM). The phase in Ti-35Ta-xNb alloys were confirmed by X-ray diffraction (XRD). The morphology of the nanotube was characterized by a field-emission scanning electron microscopy (FE-SEM).

3. Conclusion

The surface characteristics of anodized alloy depended on the nanotube formed voltage and alloy element. The HA precipitation morphology was influenced by nanorubular structure of alloys.

Reference

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