Bone-like Apatite Formation onhydroxyapatite Coating on Ti-40Nb-xHf Alloy

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Ti alloys, such aspure Ti and Ti-6Al-4V ELI alloys, are considered suitable structuralbiomaterials and are widely used for hard tissue replacement such as artificialhip, shoulder and knee joints, dental implants. Corrosion resistance andbiocompatibility are excellent. Ti-6Al-4V alloys are acceptable prostheticmaterials, but recent studies have shown that the release and accumulation ofAl and V ions can have a detrimental effect on the human body.

Recent developments in the research anddevelopment of titanium alloys in biomedical applications are aimed at thedevelopment of titanium alloys composed of non-toxic and non-allergenicelements with low modulus of elasticity and good mechanical properties.

Therefore, someinvestigators have focused on the development of Al and V free Ti alloys thatcontain non-toxic element such as Niobium (Nb), Tantalum (Ta), Zirconia (Zr)and Hafnium (Hf) for biomedical applications.

In particular, Nbhas identified as a non-toxic element that does not cause any adverse reactionin the human body. Accordingly, research has focused on β-Ti alloys, due totheir increased biocompatibility and decreased elastic modulus.

Since, Hf belongsto the same group as titanium in the periodic table of elements, titanium alloyedwith this element will likely have good corrosion resistance andbiocompatibility.

Hydroxyapatite (HA)is a bioactive material with a calcium to phosphorous ratio that is similar tothat of mineral bone. It has been used as a bone replacement material inrestorative dental implant.

Inthis study, First, nanotubes were formed on the Ti-40Nb-xHf alloy by apotentiometer on 1M H_3PO_4 containing 0.8 wt%NaF at roomtemperature on the Ti-40Nb-xHf alloy. Second, after forming the nanotubes, theinitial nanotube layer was removed, and then the alloy surface was coated withhydroxyapatite (HA) using PEO. Experiments, phase transformation and morphologyof surface deformation on Ti-40Nb-xHf alloys were analyzed by X-ray diffraction(XRD), field emission scanning electron microscopy (FE-SEM) and energy dispersive X-ray spectroscopy (EDS).

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