Shapes of Bone-like Apatite Formation on Sr and Si-doped Hydroxyapatite Surface of Ti-6Al-4V Alloy after Plasma Electrolytic Oxidation

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Metallic biomaterials have been mainly used for the fabrication of medical devices for the replacement of hard tissue such as artificial hip joints, bone plates, and dental implants. Because they are very reliable on the viewpoint of mechanical performance. This trend is expected to continue. Especially, Ti and Ti alloys are bio-inert. So, they do not chemically bond to the bone, whereas they physically bond with bone tissue. For their poor surface biocompatibility, the surface of Ti alloys has to be modified to improve the surface osteoinductivity. Recently, ceramic-like coatings on titanium, produced by plasma electrolytic oxidation (PEO), have been developed with calcium- and phosphorus-enriched surfaces. Also included the influences of coatings, which can accelerate healing and cell integration, as well as improve tribological properties. However, the adhesions of these coatings to the Ti surface need to be improved for clinical use.

Particularly Silicon (Si) has been found to be essential for normal bone, cartilage growth and development. This hydroxyapatite, modified with the inclusion of small concentrations of silicon has been demonstrating to improve the osteoblast proliferation and the bone extracellular matrix production. Strontium-containing hydroxyapatite (Sr-HA) was designed as a filling material to improve the biocompatibility of bone cement. In vitro, the presence of strontium in the coating enhances osteoblast activity and differentiation, whereas it inhibits osteoclast production and proliferation.

The objective of this work was to study shapes of bone-like apatite formation on Sr and Si-doped hydroxyapatite surface of Ti-6Al-4V alloy after plasma electrolytic oxidation. Anodized alloys was prepared at 270V~300V voltages with various concentrations of Si and Sr ions. Bone-like apatite formation was carried out in SBF solution. The morphology of PEO, phase and composition of oxide surface of Ti-6Al-4V alloys were examined by FE-SEM, EDS, and XRD(Supported by NRF: 2015H1C1A1035241 & NRF: No.2008-0062283 ; hcchoe@chosun.ac.kr).

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