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Microstructures and Mechanical Properties of Biocompatible Ti-35%Nb-2.5%Sn Alloy for Biomedical Applications

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Ti-35%Nb-2.5%Sn powder was prepared by high-energy ball milling. The particle size, phase transformation and microstructure of the as-milled powder were investigated by particle size distribution(PSD) analyzer, scanning electron microscope(SEM), X-ray diffractometer(XRD), transmission electron microscope(TEM) and differential thermal analysis(DTA). The milled powders were densified by heating up to a sintering temperature varied from 800 to 1100℃ with PCAS(Pulse Current Activated by Sintering). PCAS was effective method to fabricate the fine grain and fully densified Ti-35%Nb-2.5%Sn alloy. The density of the compacts consisting of the milled Ti-35%Nb-2.5%Sn powder increased with increase of sintering temperature, but that of the compacts consisting of Ti-35%Nb-2.5%Sn powder blend only increased with increase of sintering temperature up to 950℃. Microstructural examination of PCAS sintered Ti-35%Nb-2.5%Sn alloy using 4h-milled powder showed Nb-rich phase and Nb-poor phase which are fine and homogeneously distributed. The sintered Ti-35%Nb-2.5%Sn alloy with milled powder showed higher hardness and better wear resistance properties and also biocompatibility than the Ti-6Al-4V alloy.

Keywords: biomaterials, biocompatibility, corrosion resistance, ELISA(Enzyme-Linked Immuno Sorbent Assay), HEBM(high energy ball mill), sintering, Ti-Nb-Sn alloy.

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Sol-Gel법에 의한 calcium titanate buffer layer processe와 Hydroxyapatite 코팅

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The present study evaluates this effect of a (CaTiO3: CTO) intermediate coating on the bonding strength of HA to Ti6Al4V (TAV) substrate. The CTO and HA precursors were coated on TAV by sol-gel dip-coating method. A single CTO layer (~ 500 nm thickness) was coated and heat treated at 750°C prior to five times of HA coating. The HA coating showed a thickness of 8-10 μm, after the heat treatment at 600 °C. Phase formation, surface morphology, and interfacial microstructure were investigated by x-ray diffraction (XRD) and scanning electron microscopy (SEM). SEM observations revealed no cracks on the HA/CTO surface. However surface cracks were observed when HA was directly coated on TAV. The bonding strength of HA/CTO increased almost three times compare to direct HA coatings. The higher bonding strength on CTO coated sample could be attributed to the formation of micro-cracks, the high surface roughness and high interfacial bonding between HA and CTO layer.

Keywords: Sol-gel, Surface cracks, Hydroxyapatite, Bonding strength