In-vitro corrosion studies of plasma sprayed hydroxyapatite coatings fabricated from coprecipitation synthesized powder

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Abstract

Plasma sprayed bioactive hydroxyapatite (HAp) implants on Ti-6Al-4V substrates have been widely used in load-bearing applications because of their biocompatibility and their intimate contact with bone. In the present study, plasma sprayable grade hydroxyapatite powder was prepared by co-precipitation technique using mixture of precipitating agents and avoiding agglomeration process like spray drying. The powder possessed good flowability and exhibited an average agglomerated size of 87 μm. HAp coating was deposited on Ti-6Al-4V substrate using atmospheric air plasma spraying system. The as synthesized powder exhibited 97% crystallinity, whereas the coating exhibited a crystallinity of 76%. The coating thickness was ~100 μm and it consisted of mostly fully melted regions and unmelted/partially melted regions. The coating exhibited a surface roughness of 5.7 μm. The present paper discusses detailed corrosion behavior of uncoated and hydroxyapatite coated Ti-6Al-4V in simulated body fluid (Hanks` solution) condition. The HAp coated sample exhibited a smoother anodic curve when compared to uncoated substrate suggesting an improved passive nature of the coated surface. The i_{corr} values for the uncoated and HAP coated samples were found to be 20 μA cm^{-2} and 14 μA cm^{-2} respectively. Electrochemical impedance spectroscopy studies showed that the HAp coating applied on to the Ti-6Al-4V alloy does not degrade the corrosion protection of the surface but instead offers an improvement to it.

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