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Effects of Plasma Surface Modification on Bioactivity of Titanium in Bone Replacements

Xuan Yang Liu,1,2 Ray Fong,2 Paul K. Chu1, and Choon Yuen Die2

1 Dept. of Physics & Materials Science, City University of Hong Kong, Kowloon, Hong Kong
2 Shanghai Institute of Ceramics, Chinese Academy of Sciences, Shanghai 200050, China

Titanium and its alloys have been widely used in biomedical fields because of their excellent mechanical properties, high corrosion resistance and good biocompatibility. However, as biomaterials designed for permanent bone and joint replacements, the bioactivity of titanium and its alloy is relatively poor. To improve the bioactivity, the surface of titanium was modified in the work presented here, using plasma surface modification technology, including plasma spray and plasma immersion ion implantation. Two Ca-Si-O ceramic, wollastonite and diocalcium silicate, were deposited onto the surface of titanium using plasma spray. The results obtained from SEM, EDS and thin-film XRD showed that bone-like apatite was formed on the surface of the specimens with wollastonite and diocalcium silicate coating after immersion in simulated body fluid within a day, indicating that they possess excellent bioactivity. Plasma immersion ion implantation (PIII) is often used to modify the mechanical properties of biomaterials. In this work, calcium, titanium and oxygen ions were individually or co-implanted into titanium using PIII to modify its bioactivity. The bioactivity of the ion-implanted titanium was investigated by observing the formation of the bone-like apatite film on the surface of the ion-implanted titanium after immersion in a simulated body fluid for a certain period.

1 paul.chu@cityu.edu.hk

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