Nanoporous TiO_2 thin layer formed by electrochemical methods on titanium alloy to improve the corrosion resistance of implants in physiological solutions.

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Titanium alloys are widely recognized as the most appropriate materials for biomedical applications, due to their good corrosion resistance and mechanical properties. Among titanium alloys, Ti–6Al–4V alloy has gained wide popularity as a general-purpose alloy and more recently for biomedical applications. However, being bio inert metallic materials, they cannot connect with the bone tissue directly into a host body nor induces bone growth. To overcome this problem, porous structures were investigated extensively, since it is know that the implants with coated porous surfaces exhibit fast bone growth into open pore space, quick implant fixation and prevents implantation failure. Several surface engineering methods have been explored for preparing oxide films on titanium or its alloys. Among these methods, the production of titania coatings by anodic oxidation treatment offers some promising features. In this work, Ti-6Al-4V alloy was anodically oxidized using H_2SO_4 electrolyte. The corrosion behaviour of untreated Ti-6Al-4V alloy and nanoporous oxide film formed by controlled anodic oxidation technique in physiological solution was evaluated based on the open circuit potential (OCP) (Fig. 1), potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) measurements. The anodic formed nanoporous TiO_2 layer on Ti–6Al–4V alloy present high corrosion resistance in bio-simulated Fusayama–Mayer saliva solution as compared with untreated Ti–6Al–4V alloy surface.

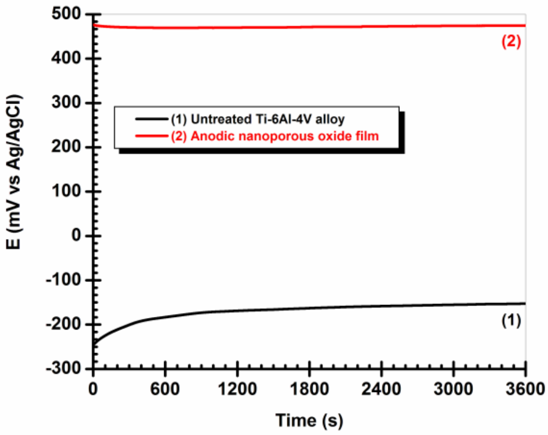

Fig.1 OCP - time plots obtained in physiological solution for: (1) untreated Ti-6Al-4V alloy and (2)