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An investigation on pulsed DC plasma electrolytic oxidation of Cp-Ti and its corrosion behaviour in simulated body fluid

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Abstract

Titania coating was produced on commercially pure titanium by a pulsed DC plasma electrolytic oxidation (PEO) process in an aqueous electrolyte containing 5 g/l trisodium orthophosphate and 2 g/l potassium hydroxide. Four different PEO coatings were fabricated with two different duty cycles (10% and 95%) and two different current frequencies (50 Hz and 1000 Hz) while maintaining a constant current density and process time of 150 mA/cm^2 and 8 min, respectively. The phase composition, roughness, thickness, surface morphology and cross-sectional microstructure of the coating were assessed using X-ray diffraction (XRD), optical profilometer, eddy current thickness gauge and scanning electron microscope (SEM). The scratch resistance of the coating was assessed by a scratch test. The corrosion behaviour of the coating was studied in a Kokubo 7.4 pH simulated body fluid (SBF) solution by open circuit potential (OCP) measurement, potentiodynamic polarisation (PDP) and electrochemical impedance spectroscopy (EIS) with equivalent circuit modelling and EIS curve fitting. Among the coatings, the coating produced at 10% duty-50 Hz frequency had a lower thickness, poor corrosion resistance (i_{corr}, 1.9 × 10^{-4} mA/cm^2) and poor scratch resistance (L_c, 15 N) while the coating produced at 95% duty-1000 Hz frequency showed

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