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An investigation on ZrO_2 nano-particle incorporation, surface properties and electrochemical corrosion behaviour of PEO coating formed on Cp-Ti

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Abstract

Plasma Electrolytic Oxidation technique was used to produce nano-sized zirconia incorporated ceramic coating over commercially pure titanium using electrolytes with varying conductivities. Electrolytes with 5 g/l trisodium orthophosphate, 4 g/l monoclinic zirconia nano-particle and varying amount of potassium hydroxide were used. The interrelationship between electrolyte conductivity, particle incorporation, surface features, corrosion behaviour and scratch resistance of the coatings were studied. The phase composition, surface morphology and surface roughness were investigated using X-ray diffraction (XRD), scanning electron microscopy (SEM) and optical profilometer. The electrochemical corrosion behaviour of the samples was analysed from potentiodynamic polarization behaviour, electrochemical impedance spectroscopy and equivalent circuit modelling in a Kokubo 7.4 pH simulated body fluid. The scratch resistance of the coatings was analysed by performing a scratch test using a Rockwell C diamond indenter with progressive loading upto 50 N. The coatings exhibited both inert and reactive incorporation