13、Surface Treatment and Inorganic Coatings

The corrosion behaviour of PEO-treated samples CP-Ti and Ti65Zr alloys

Elinor Zadkani Nahum[a], Svetlana Lugovskoy[a], Alex Lugovskoy[a], Barbara Kazanski[b]
Alexander Sobolev[a]
[a] *Department of Chemical Engineering, Ariel University, Ariel 40700000, Israel*

[b] *Azrieli College of Engineering, Jerusalem, 91035000, Israel*

Abstract This study investigated the growth patterns of hydroxyapatite on two titanium alloys: CP-Ti and Ti65Zr. The specimens underwent Plasma Electrolytic Oxidation (PEO) treatment using an alternating current with a 4 A/dm^2 density. The electrolyte solution, containing calcium acetate and calcium glycerophosphate, facilitated the incorporation of calcium and phosphorus into the oxide layer, enhancing osseointegration potential for bone tissue applications.

Following PEO treatment, the samples were submerged in Hanks' solution for varying durations. Subsequent analyses examined changes in surface morphology, chemical composition, and phase structure. Additionally, researchers evaluated surface wettability and corrosion resistance of the treated specimens.

Observations revealed minute hydroxyapatite (HA) crystal formation on CP-Ti samples after 5 and 30 minutes of PEO treatment. Notably, the Ti65Zr sample exhibited a distinct HA layer after just 5 minutes of PEO processing. Among the various immersion times tested, the Ti65Zr sample treated with PEO for 5 minutes and immersed for 14 days demonstrated the highest crystal growth rate. This behaviour was corroborated by morphological changes and electrochemical impedance spectroscopy (EIS) analysis.

X-ray diffraction (XRD) analysis of the Ti65Zr sample with 5-minute PEO treatment indicated that the Srilankite phase, comprising 60% of the surface, played a crucial role in crystal growth. This composition resulted in optimal crystal growth velocity and favorable corrosion resistance properties, with a polarization resistance (Rp) of 0.732 MΩ cm^2.