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Effect of thermal treatment and fluoride ions on the electrochemical corrosion behavior of selective laser melted CoCrW alloy

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Abstract

The electrochemical corrosion behaviors of as-SLMed CoCrW alloy after different heat treatments were investigated in 0.9% NaCl solution with and without the fluoride ions by open circuit potential (OCP), potentiodynamic polarization, electrochemical impedance measurements (EIS). The results showed that the SLMed CoCrW with a homogeneous structure experienced heat treated at 1150 °C followed by water quenching exhibited the better corrosion resistance to the electrolyte, whereas the alloy heat treated at 1150 °C followed by furnace cooling with a large amount of continuous blocky precipitates was susceptible to the corrosion. The XPS results indicated that the fluoride ions addition promoted the absorption of F⁻, Cl⁻ and Na⁺ on the passive film. The fluoride ions slightly accelerated the corrosion of the SLMed CoCrW alloy by changing the composition of the passive film, thereby reducing the protectiveness of the film. Accordingly, a corrosion mechanism associated with the fluoride ion to the as-SLMed CoCrW alloy was proposed herein.

Keywords: Corrosion; Passive film; Selective laser melting; CoCrW alloy; Fluoride ion; Dental application

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