Effect of Thermal Oxidation and Carbon Concentrations on Co-Cr-Mo Alloy in Enhanced Corrosion Protection

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ABSTRACT

Surface modification of metallic implants is often required to facilitate positive interaction between the implant and the surrounding hard tissue. In the present study, an oxide layer (Cr_2O_3) was successfully created on a Co-Cr-Mo alloys substrate by using thermal oxidation technique in atmospheric condition. The effect of different carbon content (0.03% and 0.24%) of oxidized Co-Cr-Mo alloys was investigated in terms of its corrosion behavior using electrochemical impedance spectroscopy techniques that immersed in simulated body fluid. The corrosion tests were repeated for five times for each of sample condition. The results demonstrated that thermal oxidation and carbon content have correlation in influencing the corrosion performance in Co-Cr-Mo alloys. A high carbon content sample generates a lower corrosion-rate compared to low carbon content sample even though all samples were treated at similar oxidation temperature and time duration. Observation also showed that less diffusion of cobalt released in high carbon sample which is believed has effects in creating the uniformity and dense oxide layer without any presence of microcracks and delamination. This phenomenon can be concluded that carbon content in Co-Cr-Mo alloy have influenced in controlling the reaction of metal elements during thermal oxidation which is beneficial in formation of oxide layer. The uniformity and compact oxide layer substantially have enhanced the corrosion resistance of high carbon Co-Cr-Mo alloy.

KEYWORDS: Co-Cr-Mo Alloy, Corrosion Protection, Simulated Body Fluid, Surface Morphology, Thermal Oxidation

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