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Surface Modification on CoCrMo Alloy to Improve the Adhesion Strength of Hydroxyapatite Coating

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Abstract

Surface modification is often required in order to improve the biological and tribological properties of metallic implants. In the present study, Co-Cr-Mo alloy was oxidized in atmospheric condition to create oxide interlayer (Cr_2O_3) prior to hydroxyapatite (HA) coating. The effect of oxide interlayer on the adhesion strength of HA coating on oxidized Co-Cr-Mo substrate was investigated. The surface of oxide interlayer was rough and contained abundant of pores, which helps in providing better mechanical interlocking to HA coating. Scanning electron microscopy and X-ray diffraction techniques were used to characterize the surface morphology of the HA coating whilst a Revetest scratch test was used to measure the adhesion strength of HA coating on oxidized substrates. The oxide interlayer on the substrate was able to prevent severe cracks while maintaining the porosity of the coated layer. Scratch test results showed that adhesion strength of the HA coating on substrates with interlayer was significantly higher than those without interlayer (1.40 N Vs 1.04 N; $p<0.05$). Increasing sintering temperature increases adhesion strength proportionally. These findings suggest that the porous oxide interlayer provides better anchorage whilst minimizing surface cracks of HA on Co-Cr-Mo substrates.

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Keywords: Co-Cr-Mo alloy; Thermal oxidation; Hydroxyapatite; Dip coating; Adhesion strength

1. Introduction

Cobalt chromium molybdenum (Co-Cr-Mo) alloys have long being used for orthopaedic and dental implants due to their good mechanical and biocompatibility properties [1, 2]. To improve the implant performance, HA coatings

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