Creating oxide interlayer through thermal oxidation improves adhesion strength of hydroxyapatite coating on Co-Cr-Mo substrates

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Abstract

Improvements to the adhesion strength of hydroxyapatite (HA) coat by creating an oxide interlayer on cobalt-chromium-molybdenum (Co-Cr-Mo) substrate was assessed in this study. The amorphous HA films were crystallized by sintering HA at temperatures ranging from 550°C to 750°C for 1 hour. SEM 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. 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 coatings on substrates with interlayer was significantly higher than those without interlayer (1.35 N Vs 1.04 N; $p<0.05$). Increasing sintering temperature increases adhesion strength proportionally. These findings suggest that the porosity of oxide interlayer provides better anchorage whilst minimizing surface cracks of HA on Co-Cr-Mo substrates.

Keywords: Biomaterial, Co-Cr-Mo alloy, oxide interlayer, HA, adhesion strength.