Effect of pretreatment process on thermal oxidation of biomedical grade cobalt based alloy

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ABSTRACT

Wear on Co-Cr-Mo biomedical implants is still a major issue especially for applications in articulation joints like in total ankle, knee and hip arthroplasty. Generation of excessive wear particles can coagulate in body tissues which later cause inflammation, bone loss and necrosis. Modification of implant surfaces is a common technique for increasing the hardness and thus minimizing these effects. In this study, thermal oxidation method was carried out on the Co-Cr-Mo to investigate the effects of different pretreatment processes and surface roughness on the hardness of oxide layer formed. Prior to oxidation process, all samples were annealed and pickled to remove residual stress and oxide scales respectively. The oxidation process was done inside furnace under atmospheric condition for 3 hours at 1160 °C. The metallic compositions, surface morphology and hardness of the oxide layer formed on the substrate were verified using X-ray diffraction (XRD), scanning electron microscope and micro-Vickers hardness analysis respectively. It is found that mechanical pretreatment provides oxide/carbide layer with higher hardness than chemical pretreatment method. It is believed that remnants of polishing diamond pastes trapped in roughness valleys react with metal matrix and later transform into carbides during oxidation process. In contrast, initial surface roughness of the substrate has no significant effect on the hardness of oxide/carbide layer.

KEYWORDS

Biomaterial, Co-Cr-Mo, Hardness, Implant, Pretreatment, Thermal oxidation, Wear

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