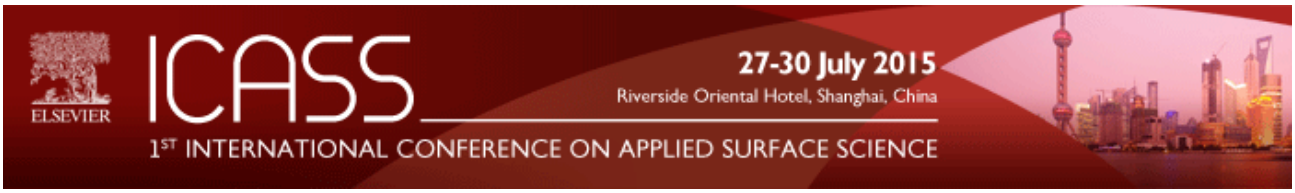

ABSTRACT SUBMISSION

Title: Corrosion resistance enhancement of Ti-6Al-4V Alloy by pulsed electron irradiation for biomedical applications

Abstract No. 0429

Title Corrosion resistance enhancement of Ti-6Al-4V Alloy by pulsed electron irradiation for biomedical applications

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Text Abstract

Metallic materials are commonly used in biomedical applications, especially with the increased use of artificial hip and knee joints in recent years. Ti-6Al-4V alloy is a widely used biomaterial for orthopaedic and dentistry applications, due to its excellent mechanical properties and corrosion resistance. However, the in-vivo environment in which it operates is aggressive in terms of mechanical loading cycles and corrosive activity of bodily fluids. Therefore, metal ions may be released from these alloys due to corrosion and wear, which may cause adverse long-term health effects. Preserving the integrity of component surfaces made from these alloys is critical to ensuring they perform correctly over the required life-cycle and do not generate excessive levels of ion release or wear particles.

In this work a large-area pulsed electron beam irradiation technique was investigated to improve corrosion performance of an orthopaedic Ti-6Al-4V alloy. The alloy samples had a lapped surface finish prior to electron beam irradiation using a Sodick PF-32A EBM machine. The process uses an argon plasma as a source of electrons which are accelerated towards and bombard the sample surface, causing surface melting and extremely rapid solidification rates of up to 10^9 K s^{-1}. For this study, samples were irradiated using a range of acceleration voltages (15-35kV) and numbers of pulses (1-25). The corrosion behaviour of the alloy treated with different acceleration voltages and pulses was investigated by electrochemical techniques including open-circuit potential measurements, polarization tests and electrochemical impedance spectroscopy in a 3.5 wt.% NaCl solution. The corrosion resistance of the titanium alloy treated by e-beam surface melting was enhanced by two orders of magnitude compared to the untreated sample. The enhancement was evaluated by assessing surface topography and microstructure from the treatment as observed by XRD, SEM and TEM characterization.

App Yes

Approval Confirm

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