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Microstructures, hardness and bioactivity of hydroxyapatite coatings deposited by direct laser melting process

Monnamme Tlotleng, Esther Akinlabi, Mukul Shukla and Sisa Pityana

ABSTRACT:

Hydroxyapatite (HAP) coatings on bioinert metals such as Ti–6Al–4V are necessary for biomedical applications. Together, HAP and Ti–6Al–4V are biocompatible and bioactive. The challenges of depositing HAP on Ti–6Al–4V with traditional thermal spraying techniques are well founded. In this paper, HAP was coated on Ti–6Al–4V using direct laser melting (DLM) process. This process, unlike the traditional coating processes, is able to achieve coatings with good metallurgical bonding and little dilution. The microstructural and mechanical properties, chemical composition and bio-activities of the produced coatings were studied with optical microscopy, scanning electron microscope equipped with energy dispersive X-ray spectroscopy, and Vickers hardness machine, and by immersion test in Hanks' solution. The results showed that the choice of the laser power has much influence on the evolving microstructure, the mechanical properties and the retainment of HAP on the surface of the coating. Also, the choice of laser power of 750 W led to no dilution. The microhardness results inferred a strong intermetallic–ceramic interfacial bonding; which meant that the 750 W coating could survive long in service. Also, the coating was softer at the surface and stronger in the heat affected zones. Hence, this process parameter setting can be considered as an optimal setting. The soak tests revealed that the surface of the coating had unmelted crystals of HAP. The CaP ratio conducted on the soaked coating was 2.00 which corresponded to tetra calcium phosphate. This coating seems attractive for metallic implant applications.