Additively manufactured titanium alloys and effect of hydroxyapatite coating for biomedical applications: a review

ABSTRACT

Metallic implants are extensively used to treat a spectrum of orthopaedic related disorders. Among the metals, titanium and its alloys are considered most excellent and indispensable material for the production of orthopaedic implants regarding their sterling mechanical properties and exceptional biocompatibility. Recently, rapid progress in developing non-toxic titanium-based alloys with modulus similar to that of human bone has inspired researchers globally. Thus, many studies have focused on titanium alloys, their heat treatment processes and several processing technologies. Additive manufacturing has been designed to enhance their mechanical properties tailored towards biomedical applications. Inarguably, the need to further improve on the implant's biocompatibility with bodily environment for optimum service life is of great importance. Hence, hydroxyapatite coating provides an improvement as demonstrated by in vitro as well as in vivo studies. The present article critically reviews, based on recent scientific literatures, the progress made thus far in the development of titanium-based alloys, additive manufacturing processes and their heat and surface treatments tailored towards biomedical applications.

Keyword: Additive manufacturing; Titanium alloys; Heat treatment; Hydroxyapatite; Biomedical applications