World Academy of Science, Engineering and Technology
International Journal of Medical and Health Sciences
Vol:9, No:02, 2015

Chemical and Physical Properties and Biocompatibility of Ti–6Al–4V Produced by Electron Beam Rapid Manufacturing and Selective Laser Melting for Biomedical Applications

Authors : Bing–Jing Zhao, Chang-Kui Liu, Hong Wang, Min Hu

Abstract : Electron beam rapid manufacturing (EBRM) or Selective laser melting is an additive manufacturing process that uses 3D CAD data as a digital information source and energy in the form of a high-power laser beam or electron beam to create three-dimensional metal parts by fusing fine metallic powders together.Object:The present study was conducted to evaluate the mechanical properties ,the phase transformation,the corrosivity and the biocompatibility of Ti-6Al-4V by EBRM,SLM and forging technique.Method: Ti-6Al-4V alloy standard test pieces were manufactured by EBRM, SLM and forging technique according to AMS4999,GB/T228 and ISO 10993.The mechanical properties were analyzed by universal test machine. The phase transformation was analyzed by X-ray diffraction and scanning electron microscopy. The corrosivity was analyzed by electrochemical method. The biocompatibility was analyzed by co-culturing with mesenchymal stem cell and analyzed by scanning electron microscopy (SEM) and alkaline phosphatase assay (ALP) to evaluate cell adhesion and differentiation, respectively. Results: The mechanical properties, the phase transformation, the corrosivity and the biocompatibility of Ti-6Al-4V by EBRM□SLM were similar to forging and meet the mechanical property requirements of AMS4999 standard. a-phase microstructure for the EBM production contrast to the a'phase microstructure of the SLM product. Mesenchymal stem cell adhesion and differentiation were well. Conclusion: The property of the Ti-6Al-4V alloy manufactured by EBRM and SLM technique can meet the medical standard from this study. But some further study should be proceeded in order to applying well in clinical practice.

Keywords : 3D printing, Electron Beam Rapid Manufacturing (EBRM), Selective Laser Melting (SLM), Computer Aided Design (CAD)
Conference Title : ICS 2015 : International Conference on Stomatology
Conference Location : London, United Kingdom
Conference Dates : February 16-17, 2015