

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

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**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 and 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)

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