Influence of microstructure on fracture feature of Ti6Al4V alloy prepared by 3D printing

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Today, most of traumatology or orthopedic implants are produced from Ti6Al4V alloy that possesses high corrosion resistance and favorable mechanical properties. The Young modulus that is the critical parameter to avoid stress shielding in healing process, is in the case of Ti6Al4V implants produced by conventional method still high comparing modulus of human bone [1]. Biomechanical compatibility of Ti6Al4V can be improved using advanced producing methods, as for example selective laser melting. However, the material prepared by this method can display some defects [2] and different fracture behavior.

In this work, the Ti6Al4V specimens produced by selective laser melting were mechanically tested in non-heat treated condition and fracture surface feature was compared with this one of the material prepared using conventional casting and forging. The results of the fractography observation for both types of the samples were explained on the base of the microstructure analysis. The fracture surface of selective laser melted specimens showed more brittle feature that was in relation with the microstructure composed almost fully of martensite as opposed to conventionally prepared alloy with (α+ β) bimodal microstructure and more ductile character of fracture surfaces.

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