STRUCTURE AND PROPERTIES OF Ti-25Nb-4Ta-8Sn ALLOY PREPARED BY SELECTIVE LASER MELTING

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Among titanium alloys for medical use, Ti-6Al-4V alloy is the most common in the field of orthopedics. Despite its excellent properties, this alloy has several drawbacks. The vanadium content, which is considered allergenic and toxic element, and the relatively high modulus of elasticity (~100 GPa) are the main obstacles of commercially used Ti-6Al-4V alloy. The modulus of elasticity of the metal implant should be as close as possible to the modulus of elasticity of the cortical bone (10-30 GPa) in order to reduce the risk of the so-called stress shielding effect. These reasons have led to the development of β titanium alloys in the past decades. β titanium alloys exhibit lower modulus of elasticity (40-70 GPa) compared to Ti-6Al-4V alloy and contain only non-toxic alloying elements, such as Nb, Ta, Mo, Zr and Sn. Furthermore, these elements can even improve properties and biocompatibility of the titanium alloys. Various methods of preparing these alloys have been investigated. 3D printing seems to be very promising mainly due to the possibility of using data from medical examinations, and thus creating a custom-made implant according to the specific requirements of individual patients. 3D printing allows creating relatively fast complex shaped products with high dimensional accuracy, good surface finish and lower contamination of the final product. However, the presence of internal stresses in 3D printed material, porosity and inhomogeneities in the structure, such as unmelted particles of the initial powder, entrapped gas and so on, are the main problems that must be solved. Appropriate setting of printing parameters, particle sizes of initial powders or subsequent heat treatment can eliminate these problems. In this work, the β titanium alloy Ti-25Nb-4Ta-8Sn prepared by Selective Laser Melting (SLM) method was investigated.