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Development of β-Ti Alloy Powders for Additive Manufacturing for Application in Patient-Specific Orthopedic Implants

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Abstract : Series of low modulus beta Ti alloy billets and powders can be produced in commercial quantities using a combination of electron beam melting (EBM) and EIGA atomization processes. In the present study, TNZT alloy powder was produced and processed in the EOSINT M290 laser sintering system to produce parts for mechanical testing. Post heat treatments such as diffusion annealing to reduce internal stresses or hot isostatic pressing to remove closed pores were not applied. The density can visually be estimated to be > 99,9 %. According to EDS study Nb, Zr, and Ta are distributed homogeneously throughout the printed sample. There are no indications for any segregation or chemical inhomogeneity, i.e. variation of the element distribution. These points to the fact that under the applied experimental conditions the melt generated by the laser rapidly cools down in the SLM (Selective Laser Melting) process. The selective laser sintering yielded dense structures with relatively good surface quality. The mechanical properties, especially the elongation (24%) along with tensile strength (> 500MPa) and modulus of elasticity (~60GPa), were found to be promising compared to titanium alloys in general.

Keywords : beta titanium alloys, additive manufacturing, powder, implants
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