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VI.8. New high entropy alloys for medical applications: A comprehensive review - PM-O9

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Titanium based alloys are finding an increasing interest in the development of alloys for biomedical applications due to their excellent mechanical, physical and biological performance. There is an increasing trend in researchers focused om improving the performance of biomedical implants. Implant materials with elasticity modulus comparable to bone (18 GPa) must be developed to ensure more uniform distribution of stress at implant and to minimize the relative movement at implant bone interface. Also, an implant material should have high tensile and compressive strength to prevent fractures and improve functional stability, should have high yield strength and fatigue strength to prevent brittle fracture under cyclic loading. Staring from these considerations a lot of researchers developed Ti-based alloys using different methods: melting and casting, powder metallurgy, thermal spraying, laser cladding, etc. The most investigated method for processing these biomaterial implants is based on arc melting followed by hot forging. In few cases were used mechanical alloying (MA) of elemental powders and spark plasma sintering (SPS) to obtain different types of implants.

The paper considers a comprehensive review on processing of biomaterial implants using powder metallurgy method starting from elemental powders and followed by spark plasma sintering (SPS) or normal compaction and sintering. The analysis is focused on the fundamentals requirements for Ti-based alloys, alloying elements, processing parameters and microstructural and mechanical properties. Last but not least will be presented possible applications of these implants.

Starting for these aspects will be investigate a new concept of Ti-based alloy with high entropy (HEA) for biomedical applications. HEA is different from the conventional metallic materials by more than five alloying elements, in proportions between 5% and 35% at., which may form simple solid solutions with BCC and/or FCC phases instead of complicated intermetallic ones. The paper considers the system TiZrNbTaFe for biomedical applications obtained by powder metallurgy (PM) route, because HEAs prepared by PM often show a greater homogeneity in the microstructure compared to the segregated microstructure of melted and cast HEAs.