Structural and mechanical properties of heat resistant titanium allows of the Ti-24.5Al-24.5Nb (at.%) system

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Heat resistant titanium alloys with various types of microstructure and homogeneous distribution of components were obtained using high-energy processing of powder mixtures in a planitary mill, followed by spark plasma sintering (SPS). Isothermal sections of the Ti-24,5Al-24,5Nb (at.%) system at SPS (1000, 1200 and 1300°C, 1550) were studied using X-ray diffraction, scanning electron microscopy and energy-dispersive spectral analysis. Three-point bending mechanical tests were carried out at room temperature on Instron 5966 universal testing machine.

Based on the study of the phase composition of mechanically activated powder compositions, it was found that during the high-energy treatment of powder mixtures, most of the aluminum component dissolves in the Ti and Nb lattices by interpenetration, forming solid solutions (Ti, Al) and (Nb, Al) and various intermediate compounds.

After SPS of mechanically activated powder mixtures for all sintered samples at 1000, 1200 and 1300°C, the presence of unreacted Nb and β/B2 phases was found. But, with an increase in the sintering temperature, the content of unreacted Nb sharply decreases, while the content of the β/B2 phase increases with transformation into the main matrix structure up to 1300°C. The microstructure of alloys of the Ti-24.5Al-24.5Nb system, in addition Nb and β/B2 phases, is characterized by the presence of γ, α2 and O phases, the morphology and quantitative content of which varies depending on the exposure temperature.

It has been determined that allows of the Ti-24.5Al-24.5Nb system, regardless the SPS temperature are characterized by low strength and ductility. Precipitation and large number of brittle α2-phases on the borders of particles are one of the main reasons for the low value of the strength properties of titanium alloys.

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