THE EFFECT OF PLASMA CARBONITRIDING ON THE CREEP RESISTANCE OF Ti-6Al-4V

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The Ti–6Al–4V alloy is the most applicable among titanium alloys due to its excellent mechanical properties and good corrosion resistance. The use of this alloy is particularly attractive in aerospace and biomaterials industry. In the other hand, the poor tribological properties and the affinity of titanium for the oxygen is one of the main factors that limit the application of these alloys as structural materials at high temperatures. In order to improve the tribological properties and to protect the alloy of oxidizing, surface treatments are used [1,2]. Carbonitriding is one of these treatments that can be used to improve the surface of the titanium alloys. In the context, the objective of this study was to evaluate the effect of plasma carbonitriding on the creep behavior of Ti-6Al-4V alloy. The samples were characterized using microhardness testing, scanning electron microscopy, roughness and X-ray diffraction. The carbonitriding treatment resulted in a compound layer of about 1.6μm with a hardness of 1450±250 HV, while the untreated sample has 300±17 HV. The thermo-chemical increased in approximately 34% the average roughness of the carbonitrided samples. The atmosphere the treatment rich in nitrogen and carbon allowed the formation of Ti_2N e Ti(C,N). Short-term creep tests were performed under constant tensile load in air at 600ºC using a dead-weight-creep-rupture machine. The creep properties of carbonitrided specimens were significantly improved in comparison with those of the untreated Ti-6Al-4V alloy. Table 1 show the creep strain rates for the carbonitrided and untreated specimens at 600°C.

Table 1: Creep strain rates at 600°C for carbonitrided and untreated specimens

Stress [MPa]	Creep strain rate [1/s]	
	Untreated	Carbonitrided
222	$1.136X10^{-5}$	$0.514x10^{-5}$
300	$4.866x10^{-5}$	$2.660x10^{-5}$

Keywords: Plasma carbonitriding, Ti-6Al-4V, creep.

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