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Abstract: Effect of cryogenic burnishing on the corrosion product film formation mechanism of Ti-6Al-4V titanium alloy has been investigated in this work. The corrosion product films of both burnished and unburnished specimens exhibited three distinct oxide layers. Compared with un-burnished specimens, burnished specimens possessed a thicker subsurface layer with high-valent oxides and additional Al_2O_3 in the inner layer. The chemical activity, diffusion, and distribution of alloy elements were changed by high-density dislocations, nano-grains, twins and compressive residual stress induced by cryogenic burnishing, resulting in the enhancement of the compactness, thickness, growth rate and protection of corrosion product film on the Ti-6Al-4V alloy.

Keywords: Titanium alloy; Cryogenic burnishing; Surface; Corrosion product films; XPS; TEM

1 Introduction

Titanium and its alloys have been proven to be an inert implant material due to their excellent properties, such as low elastic modulus, good biocompatibility and high corrosion resistance [1-3]. At present, Ti-6Al-4V titanium alloy has been widely used in medical devices [4]. However, Ti-6Al-4V titanium alloy is susceptible to corrosion in vivo due to the presence of highly aggressive chemical environments of body fluids [5, 6]. Thus, the enhancement of corrosion resistance of Ti-6Al-4V titanium alloy in vivo is urgently expected to ensure the safe and reliable usage of medical devices.

It is well known that the oxide/ corrosion product film formed on the surface of alloy has a significant impact on the

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