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脉冲电流对Ti-6Al-4V合金显微组织及力学性能的影响

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摘要 采用组织观察、性能检测、断口分析等方法研究了脉冲电流对Ti 6Al 4V合金显微组织及力学性能的影响。结果表明，脉冲电流使试样瞬间急速升温、产生较高的热压应力，并发生α→β相变，随后试样快速降温冷却发生β→α′相变。由于急速升温和快速冷却，新相的形核率增加且无充足时间长大，使合金的显微组织细化，而相变和组织细化导致了合金力学性能提高和电阻率变化。适当优化电脉冲处理工艺参数可使Ti 6Al 4V合金的综合力学性能明显提高。通过测量电阻变化可间接表征电脉冲处理后材料微观组织结构的变化程度。

关键词 材料合成与加工工艺,脉冲电流,Ti-6Al-4V合金,显微组织,力学性能

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Effect of pulse current on microstructures and mechanical properties of Ti-6Al-4V alloy

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Abstract The effects of the pulse current on the microstructures and mechanical properties of Ti 6Al 4V alloy were investigated using microstructures observation, mechanical testing and fracture analysis. The results show that pulse current causes the rapid increase in temperature of specimen, formation of comparatively high thermal compressive stress,phase transition from α to β. Subsequently, β is transformed into α′ due to higher cooling speed. As a result of highrheating and cooling rates, for the new phase,the nucleation rate increases but the growth time decreases,resulting in the refinement of the microstructure.The combination of phase transition and microstructural refinement gives rise to the improvement in mechanical properties and change in resistance of Ti 6Al 4V alloy. Mechanical properties of Ti 6Al 4V alloy can be enhanced remarkably by optimizing electropulsing parameters. Transformation degree of the microstructure canbe characterized indirectly after electropulsing treatment by measuring the change in resistance.

Key words materials synthesis and processing technology pulse current Ti 6Al 4V microstructure mechanical properties

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