航空学报 » 2011, Vol. 32 » Issue (8) :1563-1568 DOI: CNKI:11-1929/V.20110310.1711.003

Ti-6Al-4V合金氢致塑性效应与应用

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Plastic Effect of Hydrogenated Ti-6Al-4V Alloy and Its Application

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摘要 利用光学显微镜研究了置氢处理后Ti-6Al-4V合金的微观组织,通过X射线衍射分析试验研究了置氢处理过程中的相转变过程;采用室温压缩试验研究了置氢处理后Ti-6Al-4V合金的变形行为,并进行了冷镦试验。结果表明,氢促进了α″马氏体与亚稳β相的形成,亚稳β相的形成与转变是Ti-6Al-4V合金变形性能提高的主要因素;在氢含量为0.60%～0.90%时,与原始合金相比,峰值应力降低60 MPa,压缩极限提高40%以上;氢含量为0.80%时,通过冷镦成型制备了直径为φ10 mm的Ti-6Al-4V合金90°沉头螺钉。

关键词: 钛合金 Ti-6Al-4V合金 置氢处理 微观组织 变形行为 沉头螺钉

Abstract: The microstructure of hydrogenated Ti-6Al-4V alloy is studied by an optical microscope, and its phase transformations are analyzed during the hydrogenating treatment by X-ray diffraction(XRD). The deformation behavior of the hydrogenated Ti-6Al-4V alloy is investigated through compression tests at room temperature, and jumptests are performed, too. The results show that the presence of hydrogen in the alloy promotes the formation of martensite α″ and metastable phase β, and the formation and transition of metastable phase β is the major factor for the improvement of processability of Ti-6Al-4V alloy. Compared with the as-received alloy, the peak stress of hydrogenated Ti-6Al-4V with 0.60% H to 0.90% H decreases by 60 MPa and its compression limit improves by over 40%. When the hydrogen content reaches 0.80%, 90°sunk screws of diameter φ 10 mm can be prepared from Ti-6Al-4V by alloy jumptests at room temperature.

Keywords: Titanium alloys Ti-6Al-4V alloy hydrogenating treatment microstructure deformation behavior sunk screw

Received 2010-11-18;

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引用本文:

王耀奇, 侯红亮, 孙中刚. Ti-6Al-4V合金氢致塑性效应与应用[J]. 航空学报, 2011, 32(8): 1563-1568.

WANG Yaoqi, HOU Hongliang, SUN Zhonggang. Plastic Effect of Hydrogenated Ti-6Al-4V Alloy and Its Application[J]. Acta Aeronautica et Astronautica Sinica, 2011, 32(8): 1563-1568.

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