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激光冲击工艺对钛合金疲劳寿命的影响

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摘 要：研究激光加工工艺对Ti6Al4V航空钛合金叶片表面粗糙度和残余应力的影响，并分析影响表面质量的激光加工工艺参数；探讨表面粗糙度和表面残余应力对叶片疲劳寿命的影响。结果表明，采用激光冲击航空叶片，叶片表面残余压应力大大增强，从而使得其抗疲劳破坏能力增强，而表面粗糙度减小；在激光脉冲功率允许的范围内，选择合适的冲击参数能有效降低叶片表面粗糙度，而表面残余压应力对疲劳寿命的影响起主导作用。

关键字： 激光冲击；残余应力；表面粗糙度；疲劳寿命

Influence of laser-shock processing on fatigue life of titanium alloy

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Abstract: The influence of laser shock processing on surface residual stress and roughness of the titanium alloy Ti6Al4V during laser shock processing was analyzed, and the effects of the surface residual stress and roughness on aircraft structures fatigue life were investigated by the theory of fracture dynamics. The results show that with the logical parameters of laser shock processing on the aircraft structures, the higher laser power density, the greater compressive residual stress on the surface of the sample is obtained. And the surface roughness could be descent by the correct selecting laser shock parameters. Near the surface, the yield strength is increased by the laser shock, and the compressive residual stress is the main factor to enhance the fatigue life of the titanium alloys.

Key words: laser shock processing; residual stress; surface roughness; fatigue life

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