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激光与光电子技术应用

激光喷丸A356铝合金的热稳定性实验研究

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摘要: 为了研究激光喷丸技术对A356铝合金热稳定性的影响, 采用Nd: YAG激光器对其进行表面激光喷丸处理及将各试样进行220℃退火试验处理的方法, 从微观组织、显微硬度及残余应力等方面进行理论分析和实验验证, 取得了一系列实验数据。结果表明, 激光喷丸处理能够有效提高A356铝合金的热稳定性能, 且在材料表面诱导了较大残余压应力, 显微硬度和位错密度得到显著提高, 晶粒明显细化; 退火后, 激光喷丸试样的表面残余压应力下降了30.68%, 位错密度从1.63° 降到1.51°, 显微硬度下降19.42%, 表层晶粒尺寸有所长大, 但较基体而言, 其晶粒尺寸长大幅度较小。这一结果对于拓展激光喷丸技术和A356铝合金的应用领域是有帮助的。

关键词: 激光技术 热稳定性 激光喷丸强化 残余压应力 位错密度

Experimental study on thermal stability of A356 Al alloy treated by laser shock peening

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Abstract: In order to study the influence of laser shock peening on the thermal stability property of A356 Al alloy, after laser shock peening A356 Al alloy workpieces with Nd:YAG laser and annealing them at 220℃ their microstructure, micro-hardness and residual stress were studied. A series of experimental data were got. The results showed that laser shock peening can effectively improve the thermal stability of A356 Al alloys. The large residual compressive stress was induced by laser shock peening on the surface, micro-hardness and the surface dislocation density was increased significantly; the grain

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was refined obviously. After annealing, the residual compressive stress was decreased by 30.68%, the dislocation density (full width at half maximum) was decreased from 1.63° to 1.51° , and the micro-hardness was decreased by 19.42%, the grain size on the surface layer was grown up slightly. However, compared to the matrix, the scale was less. The results were helpful to expand application fields of laser shock peening and A356 Al alloy.

Keywords: laser technique thermal stability laser shock peening residual compressive stress dislocation density

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