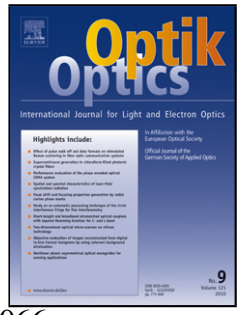

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Study on laser shock penning of Incoloy 800 super alloy

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Abstract

Enhancing the surface properties of engineering elements significantly influence the structure life and increases the functionality. The surface treatment process has great impact on improving the surface properties such as, fatigue life and hardness. In the present study an innovative surface treatment technique namely laser shock peening (LSP) was utilized to enhance the fatigue life, residual stress and surface hardness of nickel-based super alloy Incoloy 800. Here, effect of parameters such as spot diameter, pass number and laser power on aforementioned responses has been experimentally investigated. It is found from the results that increase in spot diameter, number of shocks and laser power results to impressive enhancement of fatigue life and surface hardness about 150% and 25%, respectively. It is also found that the surface protection and absorbent layer has great impact on effectiveness of LSP, where, in high laser power the absorbent layer is deteriorated due to high thermal energy that has negative influence on fatigue life and changes the type of residual stress from compressive to tension.

Keywords: Laser shock peening; fatigue; hardness; residual stress; Incoloy 800

INTRODUCTION

Laser shock peening (LSP) is a relatively surface treatment method that is applicable for improvement of surface properties of engineering structures such as fatigue life, residual stress, hardness and surface roughness. The main reason for enhancing the surface properties is exerting of compressive residual stress change due to pulsated laser impacts [1]. The LSP also changes the microstructure of the component due to massive plastic deformation that caused by laser shocks [2-4]. In this case, the LSP can be comparable with mechanical treatment processes such as shot peening and ultrasonic peening. The LSP outperforms the mechanical treatment process in some characteristic such as residual stress [1]. The LSP process can be applied for variety of metals such as iron and steel, aluminum alloys, magnesium alloys, titanium alloys, nickel-based super alloys [5-11].