Effect of Multipath Laser Shock Processing on Microhardness, Surface Roughness, and Wear Resistance of 2024-T3 Al Alloy

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Received 9 December 2013; Accepted 2 January 2014; Published 6 March 2014

Academic Editors: Y.-k. Gao and G. Schoukens

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Abstract

Laser shock processing (LSP) is an innovative surface treatment technique with high peak power, short pulse, and cold hardening for strengthening metal materials. LSP is based on the application of a high intensity pulsed laser beam

at the interface between the metallic target and the surrounding medium (a transparent confining material, normally water) forcing a sudden vaporization of the metallic surface into a high temperature and density plasma that immediately develops inducing a shock wave propagating into the material. The shock wave induces plastic deformation and a residual stress distribution in the target material. In this paper we study the increase of microhardness and surface roughness with the increase of laser pulse energy in 2024-T3 Al alloy. The influence of the thickness of the confining layer (water) on microhardness and surface roughness is also studied. In addition, the effect of LSP treatment with best conditions on wear behaviors of the alloy was investigated.