ABSTRACT

Laser shock wave treatment was performed on 7277 Al and C86400Cu-Zn alloys to reveal its effect on their microstructure and mechanical properties such as microhardness and surface roughness. The disc shape were prepared with a diameter of 10 mm and a thickness of 5 mm. The X-Ray fluorescence (XRF) technique was used to analyze the elemental composition for all samples which were used in this investigation.

The experimental procedure of the Laser shock wave treatment was operation by using a convergent lens to deliver 150 - 430 mJ (1064 nm) of energy and 10 ns laser pulse produced by Q-switched Nd: YAG laser of 1.5 mm spot size in diameter. Doubled Distilled Deionized Water (DDDW) of 4mm depth is used as transparent confining layer. The effects of the Laser shock wave treatment parameters such as laser pulse energy (150, 220, 290, 360,430) mj, number of pulses(25, 50, 75, 100, 125) and pulse repetition rate(1, 2, 3, 4, 5)Hz on the surface microhardness and surface roughness, have been investigated. The experimental results showed that, the surface roughness increases and higher micro-hardness leads to be generated near the surface of the samples.

The (Matlab R2018a) was applied on samples before and after laser treatment and system considerations a new materials hardness evaluation based on digital image processing has been presented for all sample types Al 7277 alloy and C86400 Cu-Zn alloys, with different laser pulse energy (150, 220, 290, 360,430) mj and different number of pulses (25, 50, 75, 100, 125) and their impact on the surfaces qualities of these samples. This method utilized the spatial micro structure of the digitally scanned material image.

Image pixels in spatial domain can be utilized for hardness assessment that used in this method. The experiment of measurement of hardness of the metal manually by the laboratory and by the computer (image processing) were found similar when increasing the laser power and the number of laser pulses due to increasing the hardness.