

Abstract

The process of surface hardening treatment was done via laser surface hardening followed by cooling in air temperature . The effect of different Nd-YAG pulsed laser parameters on the microstructure , microhardness, wear, and surface roughness of gray cast iron were investigated. These parameters include, pulse duration (0.8 , 1.3 and 2) *ms* , laser energy (1.84, 2.31 and 4.12)J , pulse repetition rate (1, 2 and 3)HZ, the spot diameter (0.83, 0.78 and 0.64) mm at fix wavelength (1064nm). Overlapping was also studied at different values (25%, 50% and 75%) on microhardness values.

The results showed that the microstructure of gray cast iron affected by the energy and it was observed that the increasing laser energy led to increase in the area of melted zone and heat affected zone which consists of martensite phase and irregular graphite. It was shown that the higher values of micro hardness was (1025 HV) at the spot diameter (0.64 mm), energy (4.12J) and the pulse duration (0.8*ms*). The increase in pulse repetition rate led to reducing the microhardness but the variation in the values of the microhardness decreased. The values of microhardness are increased by moving away from center of the laser spot. The loss of weight of the sample after laser treatment decreased and the wear rate decreased about (78%) with pulse duration (0.8*ms*). It was found the surface roughness decreased about (27%) after laser treatment with pulse duration (0.8*ms*). The least variation of the micro hardness values when the overlapping between the pulses was 50% .