The mathematical moduling for the influence of laser beam parameters on the depth of a heat-treated steel layer

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Abstract

Various are the Scientific researches and studies, which clarify how mathematical equations are involved in mathematical modulation operation of spot heat source that is used for local surface heating (or melting) of metals & metallic alloys. But this modulation for spot heating source , which produces high values of heating and cooling speeds , haven't been studied yet because of the complexity of mathematical equations on one hand, and the difficulty to reach a simplified mathematical module, through which approximate (facility and limited) calculations can be performed for the dimensions of the heat-treated part of metallic alloy's surface by this heating source before beginning with practical applying procedures on the other hand.

A simple mathematical module was invented through this research, which can be used to calculate the depth of the heat-treated layer, which is produced using spot heating source (Laser CO_2) for different sorts of carbon steel (various in carbon continent), before beginning of the practical applying procedures to the surface heat treatment of this steel. Laser input parameters (power & linear speed of Laser beam, , heat-treatment time, metal's heat-physical specifications) and output parameters (depth of heat-treated zone) have to be taken into consideration when using this Mathematical module. The higher discrepancy among experimental values of laser beam heat-treated zone's depth for two kinds of carbon steel , for different powers of the beam and various linear speeds, and its calculating similarities, does not exceed 16 % in many cases.

The mathematical module which had been invented in this research is characterized by simplicity and the easiness to be used, comparing with many suggested modules for such cases, and that is through the usage of the estimation of depth wanted to be done in the surface of some alloy steel with specific usage.

The primary usages of this mathematical module showed that it has future horizons with special importance, so that this module can be developed to be used in estimating the width of the heat-treated zone as well as its depth on one hand, and this module can be a basis to build another mathematical module through which the estimation of the melt carbon rates of in the net frames of the heat-treated zone's phases can be done, and so estimating the hardness values to these phases , on the other hand.

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