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MODELING OF THERMAL FIELDS DURING LASER ALLOYING WITH NITROGEN OF THE SURFACE OF STRUCTURAL STEELS*

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It is known that to increase the duration of the surfaces of machine parts and mechanisms, hardening chemical-thermal treatment is used. Recently, laser surface treatment of metals and alloys has been expanding. With this treatment, the temperature effect and its duration are important factors that determine the result of the treatment. This paper presents a computer model that makes it possible to determine and predict temperature fields on the surface of a sample during laser pulsed processing. The paper considered a two-dimensional problem of modeling thermal fields and thermal cycle. The calculations were carried out using the COMSOL Multiphysics®.

On Fig. 1. shows the direction of heat fluxes arising on a sample with dimensions of 4 × 4 × 1.5 mm. Where Q_1 is the heat flux from the pulsed laser source and directed to surface 2, Q_2 are heat losses from convective heat exchange between the environment and the body, directed from surfaces 1, 2 and 3, Q_3 are heat losses from radiation directed from surfaces 1, 2 and 3. Surface 4 is assumed to be isolated.

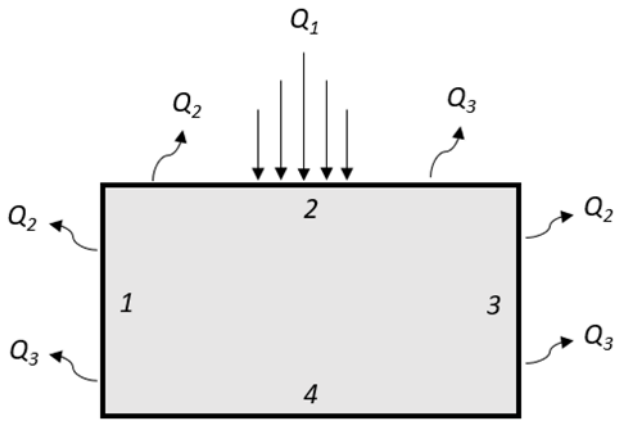

Fig.1. Two-dimensional calculation scheme of the thermal model.

This article presents a two-dimensional computer model of thermal processes when a material is heated by a stationary laser beam in a pulsed mode, which makes it possible to predict and study thermal cycles for various technological processing parameters. In addition, the developed model makes it possible to calculate thermal cycles and fields at different sample depths.

The obtained results of the calculation make it possible to determine the optimal technological modes that are relevant for chemical-thermal and heat treatment without melting the surface of metals and alloy.

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