

INFLUENCE OF THE MODES OF LASER ALLOYING ON THE PARAMETERS OF WEAR RESISTANCE OF 12Kh17T STEEL

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By using the approaches of contact mechanics, we analyze the influence of laser alloying with Nb, B, and Ni on the behavior of the parameters of wear resistance of 12Kh17T steel. It is shown that, in the process of operation of the components in the case where the force load is much lower than the yield strength of steel, it is reasonable to perform laser alloying by using a CO₂-laser with a power of 800 W.

At the same time, in the case where the load is equal to the yield strength, it is reasonable to apply a laser with a power of 6.5 kW which increases the contact strength of the subsurface layers.

Keywords: wear resistance, contact strength, laser alloying, steel.

In the process of operation of separators used for the production of ammonia, the major part of failures is connected with the wear of pins made of 12Kh17T steel with the following composition: 0.12% C, 0.8% Si, 0.8% Mn, 16–18% Cr, 0.6% Ni, and 0.6% Ti. Hence, the elevation of the strength and durability of the surface layers of these components with an aim of extension of the service life of separators is a fairly urgent problem. For this purpose, we choose laser alloying in the mode of melting and analyze its influence on the wear resistance of corrosion-resistant steels under the conditions of action of intense contact forces.

Procedure of Formation of the Surface Layers and Modeling of the Contact Interaction under the Conditions of Friction

Alloying was performed by using an LHN-702 (“Kardamon”) continuous-wave CO₂-laser with a power of 800 W, a length of emitted waves equal to 10.6 μm, a scanning speed of the beam behind the surface of the specimen $V = 400$ mm/min, and a diameter of the laser spot equal to 1.5 mm (mode I). For comparison, the procedure of treatment in mode II was carried out with the help of a continuous-wave CO₂-laser (TRUMPF) with a power of 6.3 kW and a length of emitted waves equal to 10.6 μm by using flat beams with sizes $l \times b = 20 \times 1$ mm at a scanning speed of the beam behind the surface of the specimen $V = 1690$ mm/min. In this case, a system of segmented mirrors transforms a beam of the spherical shape into a plane beam, which guarantees a more uniform distribution of the temperature field than in the LGN-702 unit and enables us to perform alloying without overlapping of the paths. As a result, the structure of the surface layers becomes more uniform and the level of stress decreases.

The surface layers were formed by blowing with nitrogen playing the role of an additional alloying element. To prepare the coating material (49% Nb + 11% B + 15% Ni + 25% graphite) [1–3], graphite powder was di-

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