

Features of the Periodic structure on the Surface of 12Cr18Ni10Ti Steel Formed Under the Action of Femtosecond Laser Irradiation



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The purpose of the work was to evaluate the peculiarities of the formation of a periodic structure on the surface of 12Cr18Ni10Ti steel under the action of a femtosecond laser. The surface structure was formed by a femtosecond titanium-sapphire TiAl₂O₃ complex as part of a Mira Optima 900-F femtosecond generator and a Legend F-1K-HE regenerative amplifier. It was established that the scanning speed of laser irradiation changes the microrelief of the surface layers of steel, the shape and dimensions of its individual fragments. In particular, low scanning speeds (0.4 mm/s) do not cause the formation of clearly oriented periodicity of the structure. At higher scanning speeds (10.0 mm/s), typical periodic surface structures oriented along the movement of the laser beam are formed. They are characterized by an alternation of almost continuous long convex grooves with elongated depressions covered with rounded structural fragments of various shapes and sizes. The formation of a peculiar microrelief of the surface can be explained by the complex effect of laser irradiation, which intensifies the processes of diffusion of steel alloying elements to the surface, initiates deformational phase transformations, promotes fragmentation and grinding of the microstructure. Adjusting the parameters of laser processing will make it possible to purposefully change the parameters of the microrelief of the surface, its structural and phase state and functional properties. Such layers with a certain ratio of nano- and microstructures, formed on small-sized products, can work as functional coatings or new materials in energy, microelectronics, and medicine.

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