THE RESEARCH INTO NEW WAYS TO MAKE OF THE CREATION OF A SUPER HYDROPHILIC SURFACE WITH ANTI-ICING PROPERTIES FOR X18H10T STAINLESS STEEL USING A NANOSECOND LASER

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Stainless steel has found a very wide application in a variety of fields. They are used in aviation, mechanical engineering and instrumentation, the food industry, the chemical industry, the automotive industry, construction, and household appliances. Often stainless steels are designed for outdoor use, while in cold weather their performance can be severely affected by icing on work surfaces. The problem of preventing icing and eliminating its influence on the operation of various equipment is the central topic of many studies. Among the promising approaches to solving this problem, it is worth highlighting a strategy based on the use of superhydrophobic surfaces. Such a strategy can provide continuous passive de-icing, and unlike active methods, it does not require the use of de-icing fluids or thermal energy to prevent freezing and de-icing. From an analysis of current research in this area, it has been found that there are several approaches to creating hydrophobic surfaces on stainless steel. The first approach to creating such surfaces is based on laser texturing followed by silane processing. From the analysis of the works on the creation of Laser-induced periodic surface structures (LIPSS), it was found that hydrophilic surfaces are formed immediately after irradiation, and only after a long time from 17 to 50 days can they become hydrophobic. However, a unified view of the mechanism of aging and the formation of hydrophobicity could not be determined. The purpose of this work was defined as trying to fill in some of the problems in this area.

To obtain the polymodal surface roughness required to achieve the superhydrophobic state, IR laser surface processing was used. In the studies, a laser setup with an IR ytterbium fiber laser (wavelength 1064 nm) and a BM 2500+ biaxial galvanometric scanner was used. Laser processing was carried out in ambient conditions with a humidity of 40-50% and a temperature of 20-25 °C. In this study, we used laser exposure with a pulse duration of 100 ns, a repetition rate of 20-100 kHz, and a peak power of up to 1 mJ in the TEM_{00} mode. The samples were scanned with a raster at a linear speed of up to 400 mm/s with a parallel line density of up to 1.25 μm.

It has been determined that nanosecond pulsed lasers can be used to create superhydrophobic surfaces using raster scanning, provided that rational parameters are chosen.

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