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VIII ВСЕРОССИЙСКАЯ НАУЧНО-ПРАКТИЧЕСКАЯ КОНФЕРЕНЦИЯ С МЕЖДУНАРОДНЫМ УЧАСТИЕМ, ПОСВЯЩЕННАЯ 50-ЛЕТИЮ ОСНОВАНИЯ ИНСТИТУТА ХИМИИ НЕФТИ

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HEAT TREATMENT OF TI-6AL-4V ALLOY, MANUFACTURED BY ELECTRON-BEAM MELTING

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Recently, additive technologies have been actively introduced in the production of functional parts from metallic materials. The use of additive technologies allows us to speed up the production process, save metal, make lighter designs with complex geometry that cannot be made using traditional methods [1]. Recently, the direction of research related to the development of methods and approaches to additional processing of metal products manufactured using additive technologies has been actively developed [2]. One of the promising areas of such research is to conduct additional heat treatment of materials [3]. The aim of the article is to study the effect of heat treatment on the mechanical properties and rate of hydrogen absorption by the Ti-6Al-4V alloy manufactured by electron beam melting.

The manufacturing of samples was carried out on the special equipment developed and designed in Tomsk Polytechnic University. The experimental parameters were as follows: an accelerating voltage is 40 kV and melting current is 15 mA. Some samples were subjected to heat treatment. The microstructure of the samples was studied using scanning electron microscopy. The structural phase state was studied by X-ray structural analysis. The hardness of the experimental samples was measured on the KB30S using the Vickers method with loads of up to 0.5 N. The wear resistance and friction coefficient of titanium alloys were measured on the "High Temperature Tribometer". The area of wear tracks was measured with a STIL Micromeasure 3D contactless optical profilometer. The rate of hydrogen absorption was calculated during gas phase hydrogenation at 650 ° C.

Analysis of the structure-phase state of the samples by X-ray structural analysis showed that in all samples α phases of titanium with a hexagonal close-packed crystal structure and β titanium with a bulk-centered crystal modification are observed. The X-ray diffraction data showed a decrease in stresses in the β phase of titanium after heat treatment. According to SEM data, there is a change in the size of the plates of the alpha phase as a result of thermal exposure. Heat treatment has a negligible effect on the wear rate of experimental samples. Additional heat treatment of EBM Ti-6Al-4V samples leads to a significant decrease in the rate of hydrogen absorption (more than 1.5 times).

Table 1. Microhardness, wear resistance.

Sample Series	Microhardness, Hv0.5	Wear rate, $10^{-3}mm^3/Nm$
EBM Ti-6Al-4V	390±10	0.62
EBM Ti-6Al-4V after heat treatment	350±10	0.58

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