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WEAR RESISTANCE INCREASE OF CAST IRON PARTS DUE TO MODIFICATION OF SURFACE LAYER

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Keywords: wear resistance, surface metal layer modification modeling, coating technology, hardening, microstructure.

Abstract. The way of solving the problem of surface wear of products from cast iron due to development of technological processes of its strengthening treatment is offered in this article. Results of researches on thermochemical treatment of cast iron of grades EN-GJL-250 and EN-GJL-600-3 are presented. Production of hardened surface layers is achieved by purposeful formation of preset structural state of metal, i.e. by modification.

ПОВЫШЕНИЕ ИЗНОСОСТОЙКОСТИ ДЕТАЛЕЙ ИЗ ЧУГУНА ЗА СЧЕТ МОДИФИЦИРОВАНИЯ ПОВЕРХНОСТНОГО СЛОЯ

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Ключевые слова: износостойкость, модифицирование поверхностного слоя металла, технология нанесения покрытия, упрочнение, микроструктура.

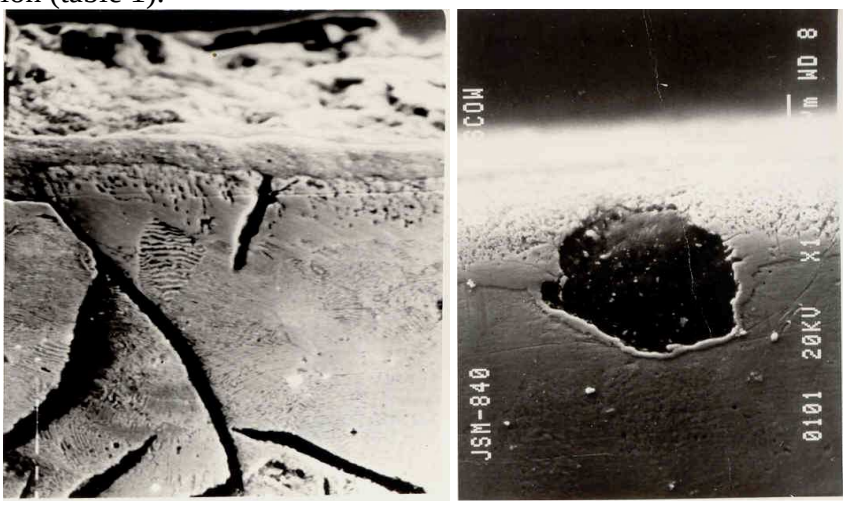
Аннотация. В статье предлагается вариант решения проблемы износа поверхности изделий из чугуна за счет разработки технологических процессов ее упрочняющей обработки. Представлены результаты исследований по химико-термической обработке чугуна марок СЧ25 и ВЧ60. Получение упрочненных поверхностных слоев достигается путем целенаправленного формирования заданного структурного состояния металла, то есть, модифицированием.

The issues of reliability prediction of mechanical engineering products and research of technologies that allow to carry out modern modernization of production [1-3] become particularly relevant in the context of globalization of the world market. One of the key points is the development and application of innovative approaches to reducing the number of failures arising from the use of products. The main cause of failure is often the wear of the main elements of the structure, which is important to prevent during the operation of the equipment [4, 5]. In most cases, the problem of increased wear arises from the fact that the work-piece surface is subjected to contact loads and it is suffered corrosion. In this regard, increased attention is paid to issues of surface engineering, which implies obtaining fundamentally new materials with a specified level of properties [6-9]. One of the effective methods of improving operational resistance is application of carbide and carbonitride chromium-based coatings on the working surface of the parts [10-12]. The most promising methods of modifying the surface of cast iron products has been investigated, namely carbonitriding.

Laboratory researches on carbonitriding of samples from gray iron and high-grade cast iron (EN-GJL-250 and EN-GJL-600-3) carried out in the molten salts of potassium cyanate *KCNO* (85%) and potash K_2CO_3 (15%) at temperatures of 550-570^{0}C. Hold time was varied in the range of 1-7 hours. A typical view of the microstructure on the surface of the cast iron samples after carbonitriding is in

Figure 1, which shows that there is a dark zone on the surface followed by a nonerodible layer having an interface with the matrix. Graphite inclusions penetrate the entire diffusion layer and extend to the surface.

During the study, it was found that carbonitriding process regimes mainly affect the quantitative phase ratio in the surface layer without changing its phase composition (table 1).



a) b)

Fig. 1. Microstructure of cast iron EN-GJL-250 (*a*) and EN-GJL-600-3(*b*)

Tab. 1. Effect of carbonitriding process duration on depth and quantitative ratio of phases in the surface layer

Pig iron grade	Duration of carbonitriding process, hours	Theoretical throat, mkm	Fractional phase content, %		
			Fe_3O_4	Fe_4N	$Fe_3(NC)$
EN-GJL-600-3	3	12,4	7	46	47
	7	20,3	34	26	40
EN-GJL-250	3	10,9	18	18	64
	7	14,0	48	22	30

Examination of samples carried out on the stand showed that in comparison with the initial state wear resistance of samples from cast iron EN-GJL-250 increased in 2,2 and from cast iron EN-GJL-600-3 – in 3 times.

Experimental-industrial tests of cast iron products (for example, parts of homogenizer pumps) after carbonitriding allowed to state increase of wear resistance of its surface by 2-4 times.

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