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MODIFICATION OF SURFACES OF STEEL PARTS WITH USE OF COAL ELECTRODE PLASMA

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Анотація

У дослідженні проводилось модифікування робочих поверхонь деталей виготовлених зі сталі, використовуючи плазму вугільного електроду з та без додавання легуючої суспензії. Досліджено структуру та твердість поверхневого шару.

Ключові слова: Структура, легуючі елементи, зносостійкість, плазма вугільного електроду.

Abstract

The paper studies the modification process of the working surfaces of parts made from steel, using a plasma of a coal electrode with and without the addition of a doping suspension. The structure and hardness of the surface layer are investigated.

Key words: Structure, alloying elements, wear resistance, plasma of a coal electrode.

Introduction

Manufacturing of steel parts has become widely used in mechanical engineering. The urgent task was to increase the reliability and durability of the parts of machines that handle heavy loads and in abrasive environments. Examples of such details are crankshafts, gears, working bodies of tillage and digging machines, etc. Various methods of chemical-thermal treatment and coating using common and special materials and equipment are used to improve the specified properties of the parts surfaces. For long-term maintenance of their successful functioning of the work surfaces, the parts provide wear resistance through various types of heat treatment, application of functional coatings, in particular by methods of electrosparking, cementation and others. A common disadvantage of such surface modification methods is the considerable cost of electricity, additive materials, time and finances.

Research results

The study examines the method of surface modification using a mixture of alloying elements and a plasma arc of a graphite electrode. To achieve the desired work goals, you must perform a number of research objectives:

1. Ensure stable arc burning and continuous operation, set the necessary parameters.
2. Investigate the effect of alloying powders (ferromolybdenum, ferrovanadium, metal chromium) on the structure of the surface layer.
3. To develop technological process of restoration of details

The studies were performed on samples of steel 40X GOST 4543-71. Alloying elements were used in the following quantities: 1 sample - molybdenum 0.5%; 2 sample - molybdenum 0.5% and vanadium 0.3%; The third sample is molybdenum 0.5%, vanadium 0.3% and chromium 2%. The experiment was carried out in the following modes: - current of 100 A, the speed of movement of the electrode for 1 sample 11 m / h, for 2 and 3 samples 5 m / h.

Microstructural analysis of the modified surfaces showed that they have a layered structure. The top layer has a maximum hardness of up to 52 HRC, and has a uniform cementitious mesh. The middle layer has a lower hardness (up to 45HRC) and consists of a fine-grained structure with spherical graphite inclusions. The last bottom layer is the base metal.

Scientific novelty of the research:

1.It is found that the treatment of the surface of the steel part with powders (Ferromolybdenum - 0.5%, Ferrovanadium - 0.3%, chromium metal - 2%), mixed in liquid glass, treated with a graphite electrode arc, allows to modify the surface layer with the formation of fine-grained structure with carbide mesh.

2. An increase in the hardness of the surface layer of 40X steel parts in the state of delivery with a suspension of doped dopants (Ferromolybdenum - 0.5%, Ferrovanadium - 0.3%, chromium metal - 2%), was first discovered, under the action of a graphite electrode arc 4 times , compared to the hardness of the base metal.

3. It is shown that the modified surface is divided into three layers, with a change in the microstructure between the first and second layers from the outer surface, and a smooth transition between the second and third layers.

Calculations were made and components were selected for equipment with numerical coating software.

The technology of surface layer modification on steel parts has been developed, which allows to ensure the hardness of surface layers and to provide adequate durability.

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