ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 11 , November 2019

# Increasing the durability of eroded parts by welding the surface of them with covered electrodes

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**ABSTRACT**: Studies have been worked on the restoration of various perishable parts with welding. The main purpose of the research is to increase the strength of the working surfaces of parts different coating by welding different types of covered electrodes. Studies have been carried out to determine the composition, structure, rigidity and eroding resistance of the welded covering material. As a result of laboratory research, the optimal composition of the covering material is determined and the optimal method of welding them to the eroded working surface of the parts is selected.

**KEY WORDS**: reconstruction, covering by welding, friction, eroding, covered electrodes.

## I. INTRODUCTION

At present, some of the friction parts in mechanical engineering are inadequate. Moreover, replacing the old parts is costly. Therefore, one of the most urgent issues today is to repair the eroded part by welding new one instead without throwing it away. The main quality indicator of the restored parts is their increased post-production work resource. The properties of the durability of parts after reconstruction should be no less than that of the new parts.
In mechanical engineering, during the operation of components, they lose their original dimensions and mechanical properties due to a variety of factors, resulting in the machines being damaged and inoperable. A large amount of metal, money and labor is required to manufacture spare parts. This in turn have an impact on the rapid development of the machine-building industry.

Today, our country pays great attention to the development of mechanical engineering as well as other areas. It also aims to provide machines and mechanisms with the latest technology. In our country, a lot of work is being done to fulfill this task.

In spite of such a number of actions in the field of mechanical engineering, today in the machine-building industry of the Republic the use of outdated or out-of-date cars continues. As a result, a large amount of expensive spare parts are being spent on their maintenance and repair. This in turn results in a reduction in the efficiency of the machines and a dramatic increase in the cost of the machines. One of the ways to reduce these costs is to reduce the consumption of spare parts by modernizing the eroded parts in a modern way.

To this day, the resource of the repaired machine was required to be 80% relative to the new one. But now this indicator is no longer satisfied with the technology users. The task is to ensure that tractors and cars after repair have to be new and more. In practice, the repair of vehicles, which is several times higher than the number of new cars purchased each year, is being re-used.

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International Journal of Advanced Research in Science, Engineering and Technology
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## II. LITERATURE SURVEY

In Central Asia, machines operate under more severe conditions, such as high air pollution and direct contact with the soil, the difficulty of providing them with regular and full service. This creates a demand for car repairs, which costs a lot of money. [1,2]

According to A.V Polyachenko [3], the bulk of the dust consists of up to 50 microns of abrasive particles. A certain amount of abrasive particles is the most aggressive for different friction pairs. As mentioned in the aforementioned works, the erosion rate increases to a certain limit as the size of abrasive particles increases to 30… 40 microns. For particles up to 5 microns, the erosion rate of the particles is 5… 7 times lower than those of particles larger than 10 microns.

In the capital work [4] of Professor M.M.Severnev is said: «In addition to the overhead costs of the rapid erosion, repair and maintenance of spare parts and components, it also causes the machine to remain in service. Therefore, the ability to operate the machines for a long time is one of the pressing problems in technology».

In the work [5] of V.M.Kryazhkov and L.S.Yermolov is given: "9 out of 10 machine failures occur because of the erosion of the details and the friction pairs." The authors of many works on the reliability, durability, and erosion of parts have given similar conclusions.

## III. RESEARCH METHOD.

The composition and physic-mechanical properties of the selected electrodes to perform this task were studied. They were welded to the surface of a metal samples with a flat surface and then composition, structure, rigidity, abrasive erosion resistance and welding strength were studied.

For ensuring the effectiveness of covering technology with welding on the eroded surface of parts, the hardness, erosion resistance and welding strength of the welded covered layer should be much higher than those of the new part. These parameters mainly depend on the composition, structure and physical and mechanical properties of the welding material. Therefore, in order to choose welding covering material, the research has been carried out on JSL-422, Э42, АНО-4, ЛЭЗ МР-3, GB/T 10044-2006 EZC, УОНИ 13/45 electrodes used in the Republic as a welding material, and electrodes such as TS-4, T-590, T-620 imported into the country to determine the prospects for restoring erosion detail.

## IV. THE OBTAINED RESULTS

It is known that under conditions of abrasive erosion, the working surfaces of working parts are generally eroded by the use of quartz sand and metal particles that have been removed from the working body. If the welded covered layer contains an element or alloy that is able to withstand rigidity and impact, it is resistant to abrasive erosion. In this regard, the composition of the selected electrodes was taken into consideration. (Table 1)

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International Journal of Advanced Research in Science, Engineering and Technology
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Table 1

Chemical composition of electrodes

| Electrodes brand | Chemical composition of the material | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | C | Si | Mn | P | S | Cr | V | Cu | B | Ni | Ti | Fe |
| T-590 | 3,2 | 2,2 | 1,2 | - | - | 25,0 | - | - | 1,0 | - | - | The rest |
| T-620 | 3,2 | 2,2 | 1,2 | - | - | 23,0 | - | - | 1,4 | - | 1,3 | The rest |
| ЦЧ-4 | 0,15 | 0,40 | 1,0 | 0,030 | 0,030 | - | 9,50 | - | - | - | - | The rest |
| УОНИ-13/45 | 0,12 | 0,18 | 0,35 | 0,03 | 0,03 | - | - | - | - | - | - | The rest |
| АНО-4 | 0,12 | 0,25 | 0,25 | 0,045 | 0,04 | - | - | - | - | - | - | The rest |
| Э42 | 0,11 | 0,17 | 0,29 | 0,034 | 0,039 | 0,06 | - | 0,12 | - | 0,05 | - | The rest |
| JSL 422 | 0,14 | 0,24 | 0,26 | 0,04 | 0,041 | 0,09 | - | 0,10 | - | 0,04 | - | The rest |
| ЛЭЗ МР-3 | 0,11 | 0,30 | 0,46 | 0,032 | 0,027 | 0,09 | - | 0,20 | - | 0,08 | 0,013 | The rest |
| GB/T 10044-2006 EZC | 0,83 | 5,08 | 0,29 | 0,02 | 0,021 | 0,05 | - | 0,09 | - | 0,03 | 0,08 | The rest |

As can be seen from the table, the T-620 and T-590 electrodes have sufficient solid alloy composition for abrasive erosion conditions. The other electrodes have no such structure.
The following mode parameters are shown in the following table for welding and covering by welding with covered electrodes. (Table 2)

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Table 2
Geometric sizes of covered electrodes and recommended power for welding

| Electrodes brand | Diameter, mm | Length, mm | Electricity power, A |
|---|---|---|---|
| Т-590 | 4,0 | 450 | 200-220 |
| | 5,0 | 450 | 250-270 |
| Т-620 | 4,0 | 450 | 200-220 |
| | 5,0 | 450 | 250-270 |
| ЦЧ-4 | 3,0 | 450 | 60-80 |
| | 4,0 | 450 | 90-120 |
| | 5,0 | 450 | 150-190 |
| УОНИ-13/45 | 3,0 | 450 | 100-130 |
| | 4,0 | 450 | 160-210 |
| | 5,0 | 450 | 220-280 |
| | 6,0 | 450 | 260-320 |
| АНО-4 | 3,0 | 450 | 90-140 |
| | 4,0 | 450 | 160-220 |
| | 5,0 | 450 | 170-260 |
| | 6,0 | 450 | 220-290 |
| Э42 | 3,0 | 350 | 90-140 |
| | 4,0 | 450 | 160-220 |
| | 5,0 | 450 | 200-240 |
| JSL 422 | 3,0 | 350 | 80-140 |
| | 4,0 | 450 | 160-220 |
| | 5,0 | 450 | 200-240 |
| ЛЭЗ МР-3 | 3,0 | 350 | 90-140 |
| | 4,0 | 450 | 160-220 |
| | 5,0 | 450 | 170-260 |
| | 6,0 | 450 | 220-290 |
| GB/T 10044-2006 EZC | 3,0 | 350 | 70-120 |
| | 4,0 | 450 | 110-180 |
| | 5,0 | 450 | 160-190 |

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International Journal of Advanced Research in Science, Engineering and Technology
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The metal samples were covered with welding according to the mode established by these electrodes and the hardness of the covered layer with welding was determined. (Table 3)

Table 3

The average hardness of the welding layer from welding the electrode

| Electrodes brand | T- 590 | T-620 | GB/T 10044-2006 EZC | ЦЧ-4 | УОНИ-13/45 | АНО-4 | ЛЭЗ МР-3 | JSL 422 | Э42 |
|---|---|---|---|---|---|---|---|---|---|
| Hardness HRC | 55-61 | 54-60 | 48-52 | 27-35 | 18-25 | 15-25 | 13-20 | 11-16 | 9-13 |

The above-mentioned covered metal samples with welding electrodes were tested on a special device designed to be tested by abrasive friction on dry sand developed by researchers. Samples were tested on a friction machine for 10 hours under 10, 20, 30, 40 and 50 N loads. (Image 1)

The test results are shown in the diagram below.

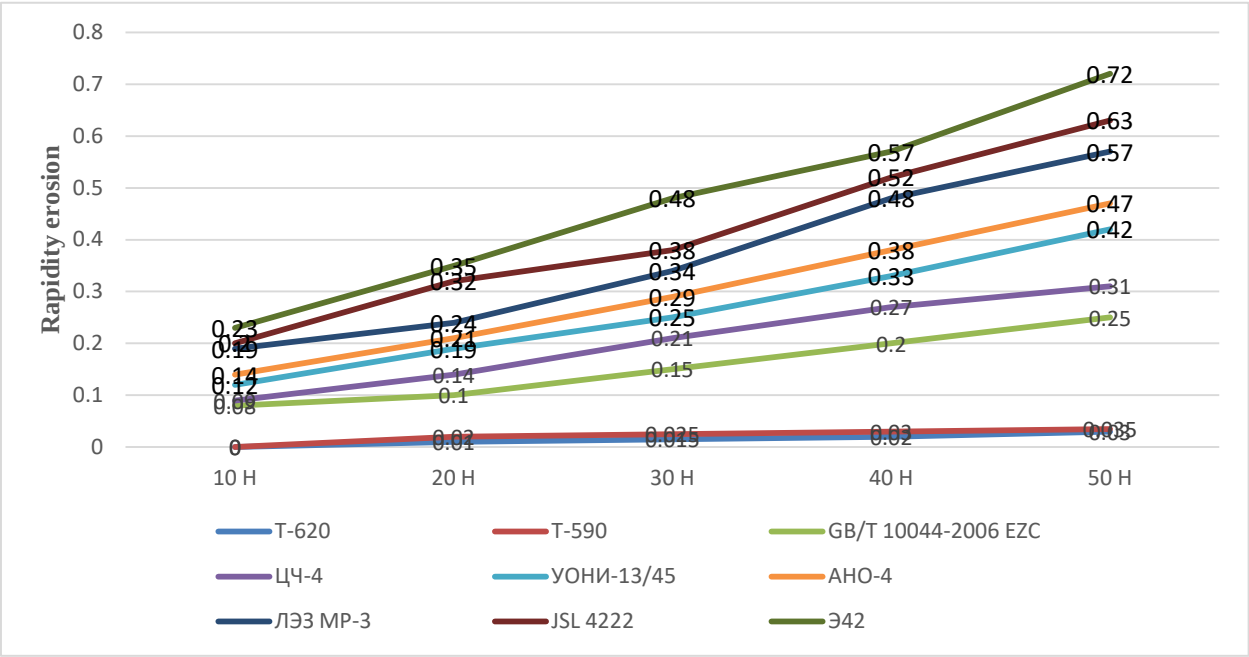


Image 1.Erosion quantities of covered samples by welding depending on electrode brands

Experiments show that the erosion of the sample covered with a T-590 and T-620 electrode showed several times less than the erosion rate of the other electrodes tested and they were proven to form solid layers.

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## V. CONCLUSIONS

1. The content of the welding material is important for increasing the erosion resistance of the parts.

2. The electrodes used for the reproduction of perishable parts have the required number of alloying elements, such as carbide and boride, to ensure their required erosion resistance.

3. Due to the fact that there is no comprehensive study on reconstruction methods based on covered electrodes, insufficient attention is paid to the restoration of the eroded parts in our Republic. Based on this, we are working on investigating the relationship between the parameters such as regeneration methods, the composition and properties of the welding material, the welding profiles, the hardness of the welded layer, the erosion resistance and the strength of the welding, which lead to the introduction of eroded parts. The results of the research will contribute to the widespread introduction of eroded part recovery technologies in our Republic.

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