Technical science and innovation

Volume 2020 | Issue 1 Article 7

3-31-2020

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N. Turakhodjaev
Tashkent State Technical University, oqibat.yunusova.tdtu@gmail.com

Sh. Chorshanbiev
Tashkent State Technical University

N. Sadikova
Tashkent State Technical University

J. Egamshukurov
Tashkent State Technical University

Recommended Citation

Turakhodjaev, N.; Chorshanbiev, Sh.; Sadikova, N.; and Egamshukurov, J. (2020) "REINFORCING THE STRENGTH OF GEAR SHAFT TEETH WITH HIGH PERFORMANCE," *Technical science and innovation*: Vol. 2020: Iss. 1, Article 7.
DOI: https://doi.org/10.51346/tstu-01.20.1-77-0051
Available at: https://btstu.researchcommons.org/journal/vol2020/iss1/7

UDC 620.193

REINFORCING THE STRENGTH OF GEAR SHAFT TEETH WITH HIGH PERFORMANCE

N.Turakhodjaev, Sh.Chorshanbiev, N.Sadikova, J.Egamshukurov

Abstract. *This article presents the results of the research on the development of the technology of increasing the service life of the sheets in the working conditions of the casting at the Central Repairs and Mechanical Plant at the Almalyk Mining and Metallurgy Refinery (CPC). One of the factors that led to the loss of Val schisternia was the study of the appearance, rupture and dental breakdown of the working surfaces, which led to increased production costs. Analyzes have shown that thermal processing and so-called thermal processing are recommended to increase the working capacity of the plants and factories at the refineries of electrochemicals (EHP).*

Key words: *gear shaft, thermal treatment, temperature, alloy, steel.*

Introduction

Val-Shesternies are widely used in the metallurgical combines of the Republic of Uzbekistan, including the Almalyk MMC, Navoi Mining and Metallurgical Combine and Uzbakrom's Uzmetkombinat. Due to the use of valse shesternies, their service life is not at their level. The average service life of a Val-Shesternian is 6 months (Figure 1-2). Therefore, in the process of their preparation, a number of measures are being taken to improve the strength of the surface, which is prone to wear and are being introduced into the newest technologies developed. One of such technologies is to increase the mechanical properties of the cast product obtained by thermal treatment.

Temperature conversion is called change of its internal structure, physical, mechanical and other properties on the basis of alloy heating and cooling modes. The basic principles of steel thermal processing are Russian scientist D.K. Chernov created. This scientist has discovered critical points and argued that it could alter the structure of steel by heating and cooling. As a result of the work carried out in the early 20th century, the theory of thermal processing developed further. Russian scientists A.A. Bochvar, N.A. Minkevich, S. S., Steinberg, N.Ya. Selyakov, N.T. Tudtsov, G.V.Kurdyumov, A.P.Gulyaeva, others, from England and Germany R. Mel, E. Brain, G. Ganneman, F. Vefer, G. Esser and others are doing the same. Uzbek scientists are also in the process of developing the science of thermal performance of alloys. Professor AMDurakhodjaev, professor NRTurakhodjaev, docent Sh.A.Karimov, docent D.M. Berdyev, thermocyclic and high-temperature welding of mechanical properties of details on the basis of thermal processing methods

1-picture. Val-shesternia teeth

2-picture. The condition of the Val-shesternia.

It is important to increase the strength of the alloy by thermal performance, as it can change their mechanical properties in a wide range through thermal operation. The purpose of the thermal processing of the alloys is to bring the mechanical properties to the required level by changing the structure (structure).

In steel thermal operation there are four major phase changes according to diagram:

$$Fe - Fe_3C$$

1) If we heat up the alloy above the A1 phase change line, the perlite will decay to austenite.:

$Fe_{\alpha}(C) + Fe_3C \rightarrow Fe_{\gamma}(\mathrm{C})$

2) When the austenite is cooled down at a temperature less than the A1 phase transition, the austenite breaks down into perlite:

$Fe_{\gamma}(\mathrm{C}) \rightarrow Fe_{\alpha}(C) + Fe_3C$

3) metastable equilibrium temperature is less than that of the austenite martensite:

$Fe_{\gamma}(\mathrm{C}) \rightarrow Fe_{\alpha}(C)$

4) at the desired temperature, the martensite is decayed to perlite:

$Fe_{\alpha}(C) \rightarrow Fe_{\alpha}(C) + Fe_3C$

In addition, there is a technology to enhance the mechanical properties of the surface by processing, one of which is nitrogen. Nitrogen is a nitrogen-diffusion pathway to the outer layer of steel. It increases the resistance of the surface to toughness, resistance to corrosion in the air, in the aqueous, steamy and so on.

This method provides for nitrogen-based particles, which are made of cast iron materials. The hardness of the surface reaches 1100 NV, but the nitrogen process takes longer than the carbon saturation process. Diffusion metallurgy is the aluminum, chrome, silicon saturation of the outer layer of steel. With aluminum, it is possible to wrap up the details in metalworking. It can also be used at temperatures up to 1200 ° C. Silicon fertilizer increases the tolerance to 800-850 ° C, increases frictional resistance and corrosion tolerance in some acids.

Chromium hardness increases the corrosion resistance by up to 1,600 ... 1,800 NV. The metal in the fluorescence metal produces compounds of iron that are degradable. Diffusion metal extraction is technically efficient, cost-effective. The details made of carbon steel and covered with chrome, aluminum, silicon, are thinner. This is very useful for the preparation of precious stainless steel bars.

Research Methods

The Almalyk MMC has carried out researches in order to increase the durability and strength of the surface by thermo-processing in Val-Shesterny under the production conditions.

During Val-shesterny's preparation, it was investigated to modify its technological route, to develop effective thermal processing technology, and to provide relief surfaces for Val-Shesternia's shear surfaces and gear wheels.

Thermal treatment modalities were optimized based on the study of the impact of the surface of the workpiece on the dimensions and solids resistance, and the processing modes were examined in the test laboratory equipment. Table 1 shows the degree of dependence on the cooling intensity of the environment used for thermal treatment.

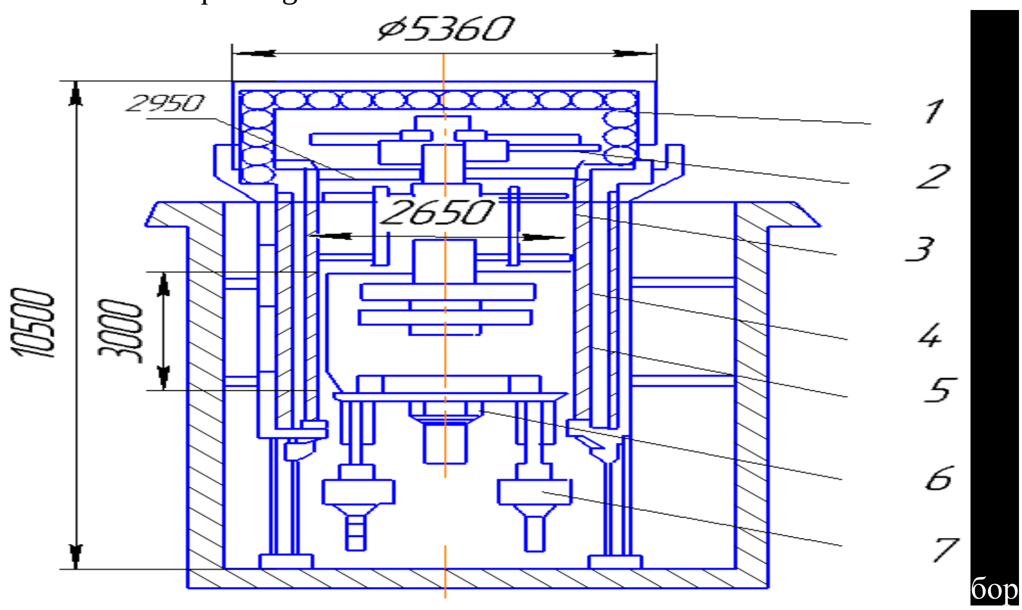
1-table

Cooling intensity of compaction media

Heating environments and their beginning temperature	Steam suspension output temperature (boiling)	Cooling relative intensity
Water, 20^0S	400. ..100	1,0
Water, 40^0S	350 ..100	0,7
Water, 80^0C	280 ..100	0,2
10% NCI solution in water, 20 ° C	650 ..100	3,0
The solution of 10% NaOH in the agar solution is 20 ° C	650 ..100	2,0
50% NaOH in water 20 ° C	650 ..100	2,0
Mineral oils, 20 ... 200'S	500 ..250	0,3

The quality of the product depends on the proper use of equipment and equipment for thermal processing. The equipment of the thermal warehouse consists of different furnaces; and in many plants, these ovens are part of special aggregates. Processes are mechanized and automated.

The Almalyk TEC is equipped with a special furnace interior for thermal treatment with equipment for electric heaters or gas burners. The units are equipped with special equipment for heating and cooling control and for changing the condition of zagotovka, furnace oven and oven removal. The aggregates are equipped with special equipment that distributes gases, checks its composition and fills the required gases.



Picture 3. Shaft electric ovens.

1 removable cover, 2 suspension base, 3 heater unit,
4 internal muffles, 5 protective muffles, 6 elastic, 7 coolers.

In the JSC "Almalyk MMC", the furnace was treated as thermal treatment equipment and its walls were covered with fireproof material, with the exterior of the wall covered with heat-resistant material and metal sheath. The oven's operating temperature was automatically controlled. Typically, these ovens are used for large sized gears (shafts, gear wheels, etc.). This oven was used due to the high efficiency of the ovens. The oven's construction diagram is shown in Figure 3.

In this oven, one of the types of thermal treatment, ie emission method, was used. The release is a termination treatment that involves keeping the treated steel from the critical point (As1) to a low temperature, maintaining that temperature and slow or rapid cooling. The purpose of the vacuum is to remove or eliminate the steel tension and reduce the hardness of the stain.

Two types of emptying were included in the study. The first step was to release at low temperatures, and in the second step the high temperature release method was used.

In the first step, the steel was heated to a temperature of 150-600 ° C. At lower temperatures, steamed steel was heated up to 150-250 ° C. The specific time (1-3 hours) was kept at this temperature and the detail of the decomposed martensite structure was obtained. At low temperatures, the tension in the tension has been eliminated. According to the theory, if the residue of steel is austenite, the hardness can be increased to 2-3 units after release at low temperatures. Therefore, lower emission reduction tools were used after centrifugal curing. The tempered steel was heated to a temperature of 350-450 ° C at an average temperature. After this release, the elasticity of the products improved, the hardness reached 41-46 HRC, and the durability increased by 1.2-1.3 times.

At the second stage of the study release was carried out at a high temperature. At high temperatures the purified material was heated up to 450-650 ° C. At the same time, the formation of the sorbitol was observed after some time.

Research results and their discussion.

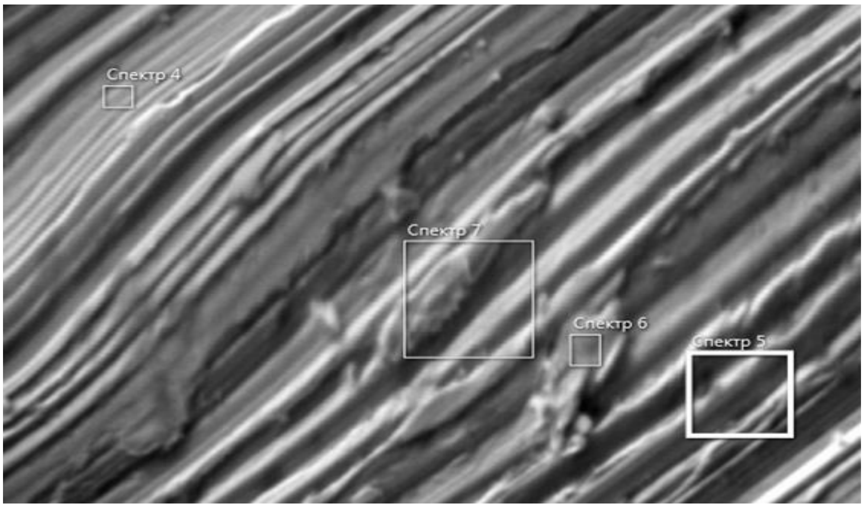
Picture 4. EVO-MA-10 Scanning Electron Microscopy (Carl Zeiss)

Picture 5. Intelligent diffractometer (Empyrean Malvern Panalytical)

The results of the research were used with a scanning electron microscope (SEM) and intellectual diffractometer (Empyrean Malvern Panalytical), to find the chemical properties of the metal samples, one or more clear images and surface properties to increase the validity of the val shesterna teeth (4-5-picture).

Results

According to the findings of the research, it was found out that the choice of the type of emission from the thermal treatment to increase the mechanical properties of the valve sheets and to bring their service life to the required level. It was found out that the use of low heat treatment would be economical. The sample of the sample in a scanning electron microscope indicates a structural change in the surface of the finished product. Due to the reduction of the stresses caused by the surface cracks in the surface of the dislocated val-shesternia, the surface plane was ensured.



Picture 6. Image of metal in a scanning electron microscope.

The analysis of the elements of the wet shesternia is given in Table 2.

Elements	Weight%	Sigma Weight%
C	7.40	0.28
O	3.30	0.13
F	2.40	0.21
Si	0.50	0.05
Cl	0.16	0.05
Fe	86.25	0.35
Total:	100.00	

Table 2. Element Analysis Analysis.

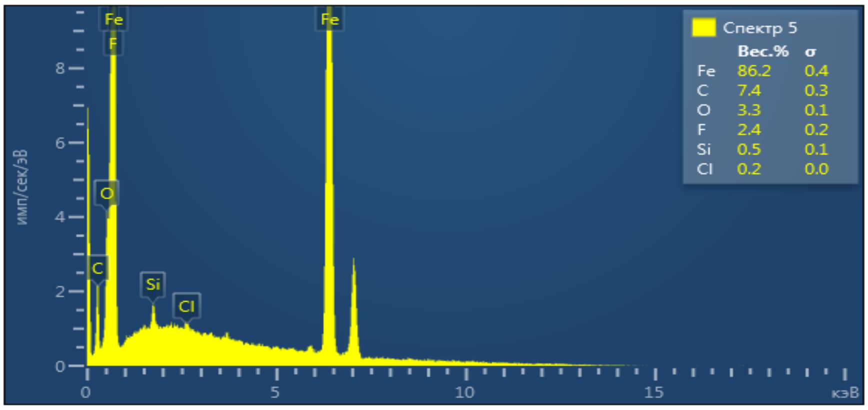
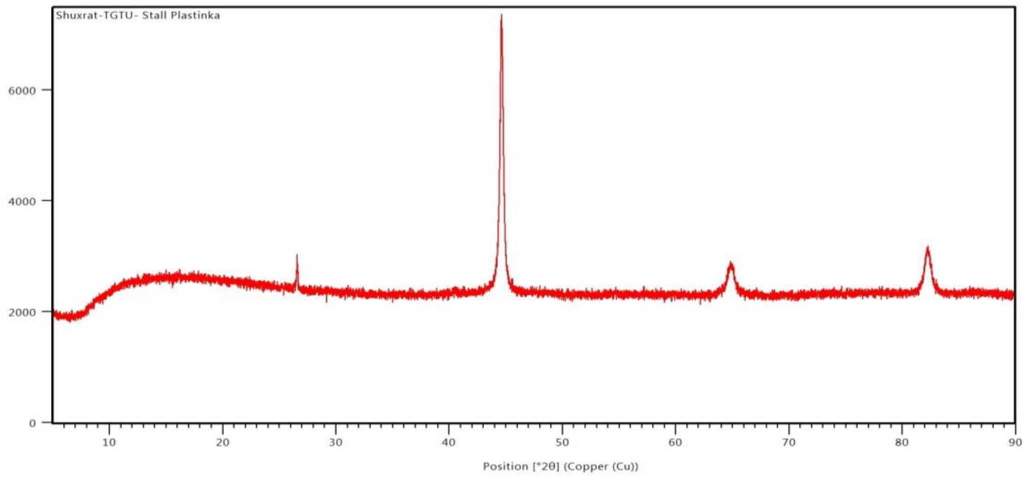
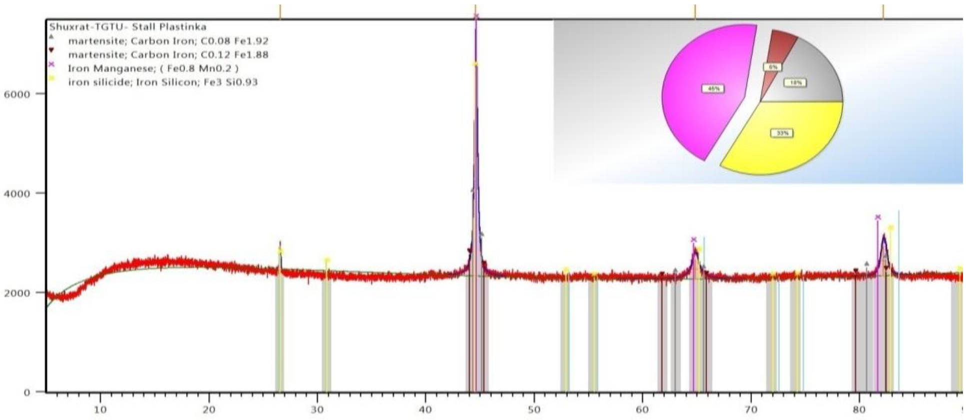


Figure 8: An elemental analysis of electro-microscopy elements.



Picture 9. The state of the PICs identified by the software.



Picture 10. The state of the X-rays that are identified by phases.

Based on the above mentioned results, low-temperature discharge method was recommended for the preparation of val-shesterny at the Central-repairing Mechanical Plant at the Almalyk MMC. In this study, Empiran Malvern's Panalytical diffractometers received X-rays (photos taken on the X-ray machine), which measure the samples. PIK (waves) were detected by the software, and effective PSAs were extracted from the background with the sample. The X-rays were identified by phases, and supplemented by predictive elements. The PHCs were identified by the phases and the phases of the phases were accepted by the program (Figure 9-10).

The length of the projection length in the horizontal plane through the material SEM microscopes was measured by the distance between the points corresponding to the flat and horizontal surface of the object. The electron beams were constantly monitored by the surface of the object and its image was formed by a microscope. Each point of the surface of the object is shown by the point corresponding to the image created in the form of a microscope. When the electrons reacted with the surface of the object, several response signals were simultaneously present. Depending on which alarm detector has been introduced, microscopes have produced one or more sharp images (5-6 pictures).

Conclusion

Based on the above, the technology of increasing the service life of the Val-Shesternia teeth in the casting method has been developed;

- It is recommended to work out a low-temperature discharge method to increase the working resource by 1.2-1.4 times;
- the use of low-temperature discharges in the manufacture of windshields is based on the fact that energy efficiency is 10-12%;
- It was found that in the preparation of valve sheets, it is possible to maintain the surface stability by nitrogen.

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