Development of High Chromium White Cast Iron Liquefaction Technology

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ABSTRACT

In this paper, high-chromium 280X29NL cast iron is reduced to 28.86 – 31% to 14 – 15%, 1% gchach Cu is added, the chemical composition is changed and the new brand 280X15TDL alloy is economically cheap and brittle, without reducing the mechanical properties of the alloy 0.4 was liquefied in an induction furnace. For thermal treatment of the alloy, they were heated to a certain temperature by SNOL – 7.2 / 1100 muffle furnace and cooled in air after standing for a certain time at a temperature of 8500 C. In this process, the chemical composition of the alloy did not change, but its properties changed due to changes in its structure.

Keywords: Copper, induction furnace, muffle furnace, microstructure,

Introduction

Today, research is being conducted to further increase economic efficiency by increasing the strength of mechanical parts obtained by casting, improving their mechanical and operational properties. In this regard, targeted research is one of the important tasks, including the implementation of scientific research in the following areas: increasing the number of crystallization centers during the cooling of corrosion-resistant white cast iron and obtaining fine-grained, evenly distributed structural castings; improving the chemical composition of refractory white cast iron and improving its mechanical and operational properties; special attention is paid to the development of new optimal standards of thermal treatment.

With the development of metallurgy and foundry in the country, a wide range of measures are being taken to conduct research on the production of bulk products from import – substitutable cast iron, and certain results are being achieved. The Action Strategy for the further development of the Republic of Uzbekistan for 2017 – 2021 sets important tasks, including "... on measures to improve the treatment of ferrous and non – ferrous scrap, waste". In carrying out these tasks, including the further improvement of casting

technologies of ductile alloys, improving the quality of castings, the development of the foundry industry on the basis of modern requirements for the production of castings, and the optimal composition of alloys and heat treatment standards to increase the ductility of castings development is important [1 – 2].

According to the results of research conducted by professors and teachers of the Department of Foundry Technology of Tashkent State Technical University on the basis of research conducted at NMP of Navoi Mining and Metallurgical Enterprise, currently a number of enterprises in mining, metallurgy, chemical engineering and similar casting of working machine parts from alloy cast iron is underway. The main brands of cast iron are ICh290X28N2, ICh260X17N3G3, ICh290X12M, ICh290X12G5, 280X29NL, 300X32N2M2TL and others.

Nowadays, mechanical engineering requires the use of materials with good mechanical properties, but alloys that increase the tensile strength, relative elongation and strength, as well as their properties such as abrasion resistance, corrosion resistance, heat resistance, ie other types of abrasive and aggressive details are important to increase the service life of parts under different operating conditions. First of all, it applies to alloys such as iron-carbon alloys, including high – chromium cast iron, the production of which is increasing year by year [3 – 4].

The corrosion resistance of cast iron is mainly provided by carbides with a structure $(Cr, Fe, Mn)_7C_3$. This is because this carbide is 1.5 – 2.0 times harder than cementite carbide. Another complication is that the amount of chromium in cast iron, which has 3% C for the formation of carbides in the system $(Cr, Fe, Mn)_7 C_3$, ranges from a maximum of 12 to 27% [5].

Materials And Methods

At present, the defects in the disks of CEMCO and BARMAK crushers operating on the basis of centrifugal force in the process of crushing ore in the production conditions of NMP of Navoi Mining and Metallurgical Plant and the causes of their formation were analyzed.

Figure 1. Appearance of a disc cast that has become unusable

In order to increase the service life of the part by changing its chemical composition, the results were obtained by providing strength on the surfaces of parts with a high tendency to corrosion under the influence of strong stress and a high probability of cracking. Research work on corrosion – resistant high – chromium cast iron-based cast alloys of domestic and foreign manufacturers and analysis of research conducted by foreign research institutions and laboratories to extend the service life of cast discs made of chromium cast iron with high ductility.

Cast-in-place high-chromium cast iron CEMCO and BARMAK crushers, which operate mainly under centrifugal force, work under high friction conditions and to increase their service life [6 – 7]. The chemical composition of the alloy is proposed below Table 1

Table 1

The chemical composition of the proposed alloy

Brand	Elements, %								
	C	Si	Mn	Cr	Mo	Ni	Cu	P	S
280X15TDL	2,8-3,0	1,1-1,2	0,6-0,8	14-15	0,8-1,0	0,9-1,0	0,9-1,0	0,02-0,04	0,07-0,09

After coordination, the slag material was heated in an IST – 0.4 furnace to a temperature of 1400 – 1450^0 C, ferroalloys were introduced after the slag was removed, and after holding for 10 minutes, it was poured into a sand-clay mold.

After cooling in a cast – clay mold, it was mechanically processed and the chemical composition of the alloy was determined using the equipment "SPEKTROLAB – 10M".

Table 2

Chemical composition of the alloy

Brand	Elements , %								
	C	Si	Mn	Cr	Mo	Ni	Cu	P	S
280X15TDL	2,75	0,99	0,67	13,88	2,07	0,79	1,05	0,070	0,036

Figure 2. SNOL – 7.2 / 1100 muffle furnace

SNOL-7,2 / 1100 muffle furnace was used for heat treatment to improve the internal structure (structure), physical and mechanical properties of alloys obtained by the casting method.

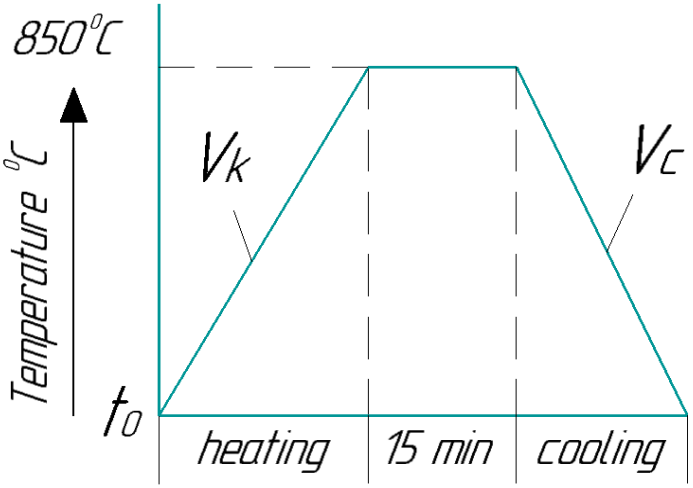

Figure 3. 280X14MDL alloy 15 minutes heat treatment mode at a temperature of 850^0 C

A TK – 2M hardness tester and a METAM RV – 23 microscope were used to determine the alloy hardness of the samples and to analyze the alloy microstructure.

Results

In order to increase the strength of the discs of crushers (crushers) operating under high stress from high chromium cast iron, the chemical composition of the charge material for the production of high-chromium cast iron with a strong and dendritic structure was increased on the basis of alloying elements. The results showed that research in this area could yield the expected results.

After the samples were cooled in a sand-clay mold, they were heat treated to increase their strength and brittleness.

The sample was cooled in air after being kept in a SNOL – 7.2/1100 muffle furnace at 850^0 C for 15 min. When the samples were examined on the METAM RV – 23 equipment, a uniformly distributed dendritic structure was observed on the surface of the microfields of the samples.

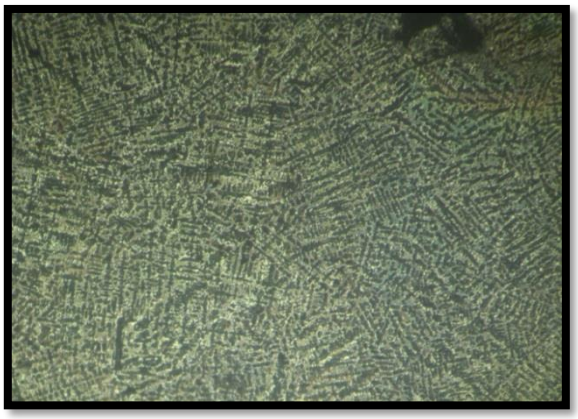

Figure 4. 100X magnification of 280X14MDL alloy before heat treatment by METAM PB – 23 before heat treatment

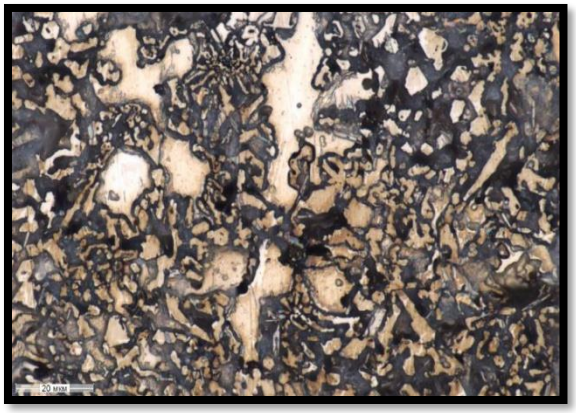

Figure 5. 281X14MDL alloy after heat treatment SEM Zeiss EVO MA 10 scanned electron microscope x1000 times magnified image

To determine the stiffness of the sample, a hardness measuring device brand TK – 2M was used and the hardness was found to be in the range of 58 – 59 HRC.

Conclusion

Based on the above data, a technology has been developed to increase the service life of the discs of CEMCO and BARMAK crushers, which operate under the influence of centrifugal force, which is obtained by casting from high – strength chromium cast iron. Based on the analysis of the initial results, the following conclusions were made:

- There is an opportunity to increase the processing resource by 1.3 – 1.5 times and to develop resource-saving technology in the production of disks;

- the samples were cooled in air after being kept in a SNOL – 7.2/1100 muffle furnace at 850^0 C for 15 minutes. As a result, a uniformly distributed dendritic structure was observed on the surface of the sample microfields, and the hardness index 58 HRC – 59 HRC was determined using a hardness tester TK – 2M to determine the hardness of the sample.;

- by changing the chemical composition of high – chromium 280X29NL cast iron and not reducing the mechanical properties of the alloy, a new brand 280X15TDL alloy was developed, which is economically inexpensive and brittle.

References

1. Turakhodjaev, N., Saidmakhamadov, N., Turakhujaeva, S., Akramov, M., Turakhujaeva, A., & Turakhodjaeva, F. (2020). EFFECT OF METAL CRYSTALLATION PERIOD ON PRODUCT QUALITY. Theoretical & Applied Science, (11), 23-31.

2. Turakhodjaev, N. D., Saidmakhamadov, N. M., Zokirov, R. S., Odilov, F. U., & Tashkhodjaeva, K. U. (2020). ANALYSIS OF DEFECTS IN WHITE CAST IRON. Theoretical & Applied Science, (6), 675-682.
3. Nodir, T., Nosir, S., Shirinkhon, T., Erkin, K., Azizakhon, T., & Mukhammadali, A. (2021). Development Of Technology To Increase Resistance Of High Chromium Cast Iron. The American Journal of Engineering and Technology, 3(03), 85-92.
4. Bekmirzaev, S., Saidmakhamadov, N., & Ubaydullaev, M. (2016). Obtaining sand-clay casting". Theory and practice of modern. Russia, (4 (12)), 112.
5. SHIRINKHON, T., AZIZAKHON, T., & NOSIR, S. (2020). Methods For Reducing Metal Oxidation When Melting Aluminum Alloys. International Journal of Innovations in Engineering Research and Technology, 7(10), 77-82.
6. Djahongirovich, T. N., & Muysinaliyevich, S. N. (2020). Important features of casting systems when casting alloy cast irons in sand-clay molds. ACADEMICIA: An International Multidisciplinary Research Journal, 10(5), 1573-1580.
7. Nodir, T., Nosir, S., Shokhista, S., Furkat, O., Nozimjon, K., & Valida B. (2021). Development of 280X29Nl Alloy Liquefaction Technology to Increase the Hardness and Corrosion Resistance of Cast Products. International Journal of Mechatronics and Applied Mechanics, 154 2021, Issue 10, Vol. I