EUROPEAN MULTIDISCIPLINARY JOURNAL OF MODERN SCIENCE
ISSN 2750-6274 https://emjms.academicjournal.io Volume: 9 | August-2022

Improvement of the Technology of Production of Quality Semi – Finished Product Products from Steel Alloy

Bekchanova Valida, PhD
Researcher, Tashkent state technical university, University Street 2, Tashkent, Uzbekistan

Turakhodjaev Nodir
DSc professor, Tashkent state technical university, University Street 2, Tashkent, Uzbekistan

Saidmakhamadov Nosir, PhD
Candidate, Tashkent state technical university, University Street 2, Tashkent, Uzbekistan

Rizaeva Nigora
Assistant teacher, Tashkent state technical university, University Street 2, Tashkent, Uzbekistan

Turaev Anvar
Senior teacher, Tashkent state technical university, University Street 2, Tashkent, Uzbekistan

Abstract: In this article, the chemical composition of A500C fittings semi – finished product was developed by summarizing the steel in order to obtain fittings products from high – quality steel alloys. In addition, the mode of liquefaction of steel alloy in an electric arc furnace was considered, in which it was possible to obtain high – quality steel semi – finished product by adding various fluxes and modifiers to the composition of the alloy during the liquefaction process.

Keywords: Electric arc furnace, steel, alloy, flux, microstructure, slag, reinforcement, semi – finished product, modifier, iron oxide, silicon carbide, ferrite, austenite.

INTRODUCTION

People have been familiar with simple methods of obtaining metal ingots for a very long time. The study of archeological finds in many countries, including Egypt, Greece, and China, showed that people took simple – shaped ingots in clay molds several hundred thousand years ago. Over the centuries, this craft has been passed down from generation to generation. Only, in the 13th – 14th centuries, castings of various shapes and sizes were made from cast iron, and from steel in the 18th – 19th centuries through sand – clay moulds [1 – 4].

Ferrous metallurgy products are the raw material for the machine – building industry, which determines the technical progress in all branches of the national economy, and is its main foundation. The first modern metallurgical plant in Central Asia was built in 1942 with the help of the people. In March 1944, the first alloy of steel was taken from the factory. In February 1945, the 2nd Marten furnace began to produce products. In August 1978, 250,000 tons of steel alloy per year was produced in the electric furnace [5 – 8].

In the second half of the 1970s, a steel liquefaction shop and a new rolling shop were put into operation at the Uzbekistan Metallurgical Plant. Control of technological processes in the steel liquefaction workshop is automated [9].

It should be noted that unlike large metallurgical plants (Magnitogorsk, Kuznetsk, Cherepovetsk, etc.), Bekobod in 1942, Almalyk in 1953, Navoi and other metallurgical plants were built in our republic, and many ferrous and non-ferrous metals and their alloys were produced there. is being produced [10].

It is known from the observations that technical pure metals (for example, Fe, Al, Su) are used in electrical and radio engineering, tantalum (Ta), niobium (Nb), hafnium (Hf), zirconium (Zr), silicon (Si) and their alloys are used in equipment manufacturing, atomic used in engineering and other fields, and in mechanical engineering, more than 90% of various machines and metal structures correspond to ferrous metal alloys (cast iron and steel) and are used [11 – 14].

The reason for this is that ferrous metal alloys have satisfactory physical, chemical, technological and mechanical properties, and are characterized by a change in their properties due to a change in their chemical composition, as well as a change in the structure due to thermal treatment, and a lower cost of the alloy.

Foundries are one of the important branches of the mechanical engineering industry, in which castings of various shapes and sizes are obtained by pouring various metals or their alloys into pre-made molds. The mass of castings (parts or their semi – finished product) can be from a few grams to 250 tons or more. As for the cast semi – finished product, their shape and size are slightly larger than the investment value, designed for mechanical processing, depending on the shape and size of the details [15 – 18].

Statistics show that about 70% by mass of cast iron produced today is gray and modified high – strength cast iron, about 20% is steel, and the rest is malleable iron and non – ferrous metal alloys.

MATERIALS AND METHODS

A 30 – ton electric arc furnace was used in order to obtain reinforcement products from high – quality steel alloys. One of the most important priorities of electric arc furnace fluidization is to obtain quality castings. At the enterprise “Lida metal technology” LLC in the city of Ohangaron, a rough estimate was made for obtaining fittings from A500C steel alloy [19]. Due to the summary of the developed schedule, it became possible to manufacture fittings under the control of GOST 52544 – 2006 STO – ASCHM 7 – 93. The semi – finished products for getting reinforcement are represented in the picture 1.

1 – picture. Semi – finished product prepared for receiving reinforcement

Until now, low – carbon steel 35G2C and 35GC was used as a production material. It is ensured that the carbon content of the alloy does not exceed 0.22% [20]. Currently, A500C steel alloy is recommended by summarizing the load. The chemical composition of the recommended A500C steel alloy is presented in Table 1.

Table 1. Chemical composition of the recommended brand A500C

Brand	C	Si	Mn	P	S	Cr	Ni	Cu
A500C	0,30 – 0,35	0,6 – 0,9	0,9 – 1,5	0,03 – 0,05	0,035 – 0,045	~ 0,3	~ 0,3	~ 0,3

First of all, an electric arc furnace was selected, which is the basis for liquidizing the steel alloy. The main reason for this is that the steel alloy is acidic, which causes the furnace lining to corrode quickly. For this reason, an electric arc furnace was used. The walls of the basic furnaces were made of magnesite brick, and the bottom was covered with magnesite powder. Before starting the furnace, it was checked that it was ready for use. Then the cover of the electric arc furnace was opened and the solid was loaded through the top of the furnace. At the same time, electrodes were introduced into the furnace, first small, and then large iron-slag waste, recycled cast iron and limestone ($CaCO_3$) as a flux. If the large solids were loaded into the furnace first, followed by the small solids, the amount of burn from the small solids could be high because the heat supplied for the main fluidization of the furnace was provided through the furnace electrodes. For this reason, the order of loading the slag into the furnace was developed, and it was achieved to reduce the amount of slag burning.

An electric arc was formed by placing electrodes on the metal pieces of the shingle, connecting the necessary rectifier and current circuit. For stable burning of the arc, small pieces of coke were placed under each electrode in order to liquefy the slag faster. Due to the high temperature zone formed around the arc, the solid material was liquefied in a short time. During the liquefaction of the slag materials, Fe was first oxidized at the expense of iron ore and furnace atmospheric oxygen, and the oxygen released as a result of melting of the formed FeO in the metal bath began to oxidize Si, P, Mn, and partly C. The formed oxides (SiO_2, P_2O_5, FeO and MnO) combine with each other and CaO to form a basic slag. To remove the slag, the slag was separated from the liquid alloy by turning 10 – 150 degrees towards the furnace window. Then, the liquid alloy was mixed with a ladle, samples were taken from three places, and the chemical composition was checked in the laboratory. FeO was added to the furnace to reduce the amount of carbon in the alloy metal was cast. The main purpose of heating the crucible is that when a steel alloy at a temperature of 1600^0 C is poured into a cold crucible, it can cause damage to the surrounding work due to splashing of the liquid alloy. On the other hand, as a result of sputtering of liquid alloy, iron reacts with oxygen to form FeO. This affects the quality of the product. For this purpose, the kovsh must be heated.

Then, in order to normalize the content of the liquid metal poured into the bucket, in the process of transferring it to the next line to check its chemical composition in the laboratory, the liquid metal was kept at a certain temperature so that the liquid metal would not cool down, and after the chemical composition was normalized, it was continuously poured into the mold with a copper pipe, and the fact that the copper pipe was poured continuously so that the copper pipe would not melt, the outgoing 4,000 – 5,000 liters of water per minute moved around the inner walls of the copper to maintain its shape. As a result, the cast metal was moving towards the conveyor in the form of a certain semi-finished product, and the semi-finished product was synchronously cut by gas cutters every 6 meters. In order to pass the semi-finished product well between the rolling mills, it was put into a gas furnace and its temperature was kept at 1000 – 1050^0 C. After heating the crucible, high – quality A500C bend – resistant corrosion – resistant fittings were produced by passing through rolled shafts of various sizes. The reinforcements were cut to 11 meters and 70 cm in size and assembled as a set. The reinforcements obtained by the rolling shafts of semi-finished product can be seen in Fig. 2.

Fig. 2. A set of prepared fittings

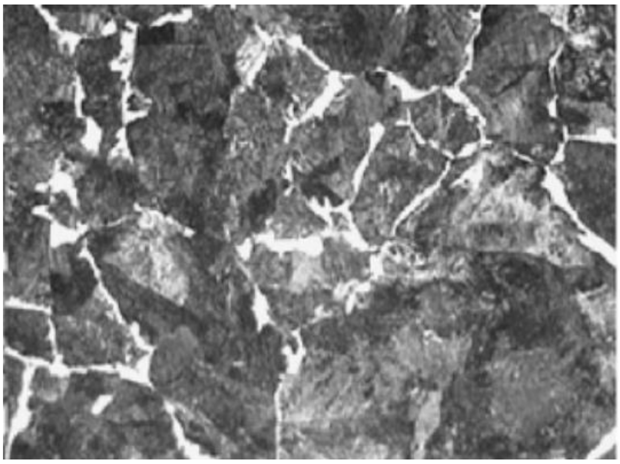
RESULT

The developed fittings, the samples were cleaned with SiC. Then it was determined in the spectral analysis device model "SPEKTROLAB - 10 M" and it is mentioned in table 2.

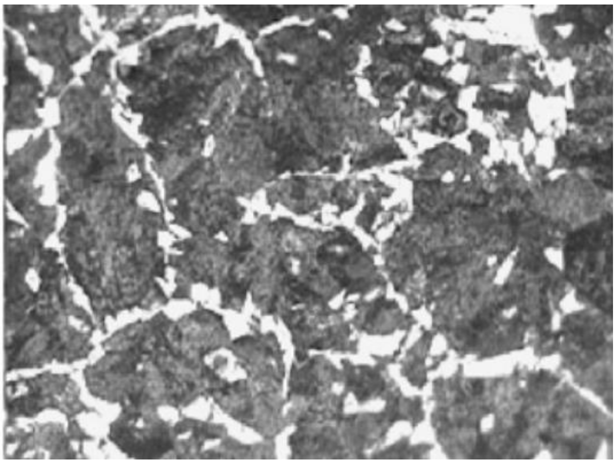
Table 2. Chemical composition of liquefied A500C brand

Brand	C	Si	Mn	P	S	Cr	Ni	Cu
A500C	0,33	0,7	1,0	0,04	0,040	~0,3	~0,3	~0,3

Samples were metallographically examined at the “Center of Advanced Technologies under the Ministry of Innovative Development” at a magnification of x500 to 1000 times on a SEM Zeiss EVO MA 10 scanning electron microscope, and the obtained results are shown in pictures 2, 3.



3 – picture. Image of alloy A500C magnified x500



4 – picture. Image of alloy A500C magnified x1000

It can be seen in pictures 3, 4 that when looking at a 10 µm field with a magnification of x500 in the scanning electron microscope of picture 3, a ferrite-pearlite and a little austenite structure was observed. In picture 4, a large-grained, pearlite – ferrite and austenite structure can be seen when looking at a 10 µm field with a magnification of x1000.

CONCLUSION

In order to obtain reinforcement products from high – quality steel alloys, a furnace was chosen to obtain a high – quality steel alloy by melting secondary charge materials. After the steel alloy was liquefied in the furnace, it was cast through a copper tube by continuous casting to obtain reinforcement from the liquid alloy. Until now, 35G2C and 35GC low – carbon steel was used as the material for the production of fittings. However, the A500C steel alloy with better mechanical properties than the above grade steel alloy was recommended. At the same time, the method of loading the charge, the mode of liquefaction of the mixture was developed. Also, it was possible to obtain high – quality semi – finished product by adding modifiers and fluxes to the liquid mixture. In short, high – quality A500C corrosion – resistant fittings were developed.

REFERENCES

1. Bekmirzaev, S., Saidmakhamadov, N., & Ubaydullaev, M. (2016). “Obtaining sand – clay casting”. Theory and practice of modern. Russia, (4 (12)), 112.
2. Саидмахамадов Н. и др. Технология предотвращения пор в отливах //Экономика и социум. – 2019. – №. 4. – С. 661 – 672.
3. Саидмахамадов Н. и др. Общая технология производства порошково констукционных материалов //Экономика и социум. – 2019. – №. 4. – С. 673 – 680.
4. Саидмахамадов Н., Хайдаров У., Эгамбердиев Б. Улучшение подготовки технологий методом специального сливания //Экономика и социум. – 2019. – №. 4. – С. 651 – 660.
5. 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.
6. 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.
7. 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.
8. 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.
9. 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.
10. Nodir T. et al. Development of 280X29Nl Alloy Liquefaction Technology to Increase the Hardness and Corrosion Resistance of Cast Products //International Journal of Mechatronics and Applied Mechanics. – 2021. – Т. 154. – С. 2021.
11. Turakhodjaev N. et al. Quality improvement of the steel melting technology in an electric arc furnace //ACADEMICIA: An International Multidisciplinary Research Journal. – 2021. – Т. 11. – №. 7. – С. 48 – 54.
12. Saidmakhamadov N., Abdullaev K., Khasanov J. Теория и практика современной науки //теория и практика современной науки Учредители: ООО" Институт управления и социально-экономического развития". – №. 2. – С. 3 – 8.
13. Nosir S. et al. Development of High Chromium White Cast Iron Liquefaction Technology //Eurasian Journal of Engineering and Technology. – 2022. – Т. 4. – С. 123 – 127.
14. Nosir S. et al. Development of technology for obtaining quality castings from steel alloys //Eurasian Journal of Engineering and Technology. – 2022. – Т. 5. – С. 135 – 138.
15. Nosir S. et al. Technology for Obtaining High Quality Castings from Resistance White Cast Iron //Eurasian Journal of Engineering and Technology. – 2022. – Т. 5. – С. 139 – 148.

16. Nosir S. et al. Technology to Increase the Hardness and Resistance of High–Chromium White Cast Iron //European Multidisciplinary Journal of Modern Science. – 2022. – T. 6. – C. 665 – 670.
17. Nosir S. et al. Development of Technology for Production of Wear – Resistant Cast Products //Middle European Scientific Bulletin. – 2022. – T. 25. 516 – 522.
18. Nosir S. et al. Improvement of the Technology of Obtaining High – Chromium Wear – Resistant White Cast Iron //Spanish Journal of Innovation and Integrity. – 2022. T. 07. 498 – 504.
19. Nosir S. et al. Study of the Effect of Copper Addition on Secondary Carbides with High Chromium Wear – Resistant White Cast Iron //International Journal of Innovative Analyses and Emerging Technology. – 2022. T. 2. 37 – 43.
20. Valida B. et al. Development of Technology of Liquefaction of Steel Alloys in Electric Furnaces //Spanish Journal of Innovation and Integrity. – 2022. T. 8. 65 – 69.