IJIAET International Journal of Innovative Analyses and Emerging Technology

| e-ISSN: 2792-4025 | http://openaccessjournals.eu | Volume: 2 Issue: 11

# Technology of Casting the Impeller Wheel Detail without Impact Loads

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**Abstract:** This article provides information and descriptions of the new alloy fluidization technology for the casting of impact-free wheel parts, as well as the processes involved in casting the alloy into the mold.

**Keywords:** Steel wheel, carbon steel, electric bow oven, gas voids, microstructures, manganese.

## Introduction

Casting of low-cost industrial products on the basis of increasing the strength of the machine-building parts obtained by the casting method, improving their mechanical and operational properties is becoming important. At the same time, one of the important issues of the foundry sector is the production of high-quality cast products using the internal capabilities of local production facilities, while reducing the import of machine-building parts due to localization.

In particular, it is possible to improve the internal transformation capabilities of metallurgical and machine-building plants by obtaining cast steel wheels that work without impact loads. In this case, the steel wheels that work without impact loads, moving on rails, are the main detail that requires high quality when transporting large loads [1].

Wheel parts are usually made of corrosion-resistant, high-carbon steels (C above 0.6%). Wheel parts working without shock loads are made of 65G steel (C 0.62-0.7%, Mn 0.9-1.2%) and its foreign analogues [2].

## Research methods

The liquefaction process was carried out in a grounded electric arc furnace at the highest level of the secondary voltage of the transformer. The voltage of the secondary winding did not exceed 170 V, the current strength of the low voltage side did not exceed 1685 A, and the high voltage side did not exceed 60.5 A. Limestone was seperated in 1-2 parts and addep up to 10-30 kg to form a thick slag. After 50-80% of the slag was melted in the furnace, 10-15 kg of limestone was added to cover the liquid metal with slag. After melting the alloy, the bath was mixed with a special spoon, a sample was taken and sent to the express laboratory through special tubes to determine the mass fraction of carbon and the chemical composition of the alloy. The chemical composition of samples 1-2-3 obtained from the mixture is shown in Table 1 [3].

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**Table 1**

| 65G alloy | Chemical composition %: | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **C** | **Si** | **Mn** | **S** | **P** | **Cr** | **Ni** | **Cu** | **Al** |
| **Example 1** | 0.58 | 0.20 | 0.95 | 0.03 | 0.03 0 | 0.2 0 | 0.2 2 | 0 .2 | 0.1 |
| **Example 2** | 0.6 0 | 0. 25 | 1. 10 | 0.035 | 0.035 | 0.25 | 0.25 | 0 .2 | 0.3 |
| **Example 3** | 0. 65 | 0.3 0 | 1.20 | 0.035 | 0.035 | 0.25 | 0.25 | 0 .2 | 0.3 |

**Determined chemical composition of samples 1-2-3 obtained during fluidization of high-carbon low-alloy steel 65G alloy**

The percentages of chemical components were controlled until the composition of the mixture was in accordance with ISO 14959-89. According to the composition, 10-15 kg of coke was added during the liquefaction period to increase the carbon content.

When the alloy is ready, it is removed from the furnace heated at 750-850 $^{o}$C and the temperature of 1580 $^{o}$C is removed from the furnace and poured into the mold prepared on the basis of the drawings for the wheel detail. The model of the wheel detail (a) and the mold form prepared based on the model (b) are shown in Figure 1..

**Figure 1**

**(a) Wood model of wheel (scat) detail**

**(b) Mold form made based on the model**

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When pouring into the mold cavity, the liquid metal was poured through the casting system and then from the top (pribil) until the cavity was filled.

The advantage of die casting is that it avoids the intrusion that can be encountered in casting.

In order to find out how free of gas pores and mirror inclusions found in the casting of steel wheels, the samples were studied under a modern microscope with magnification up to several times. The structure shows the location of austenite and trostite grains along the boundaries and the locations of cast carbide on the surface. Steel 65G samples were treated with 4% solutions of nitric and picric acids before studying their microstructures. Research work on microstructures was carried out in accordance with the requirements of ISO 3443-87.

**Figure 2**

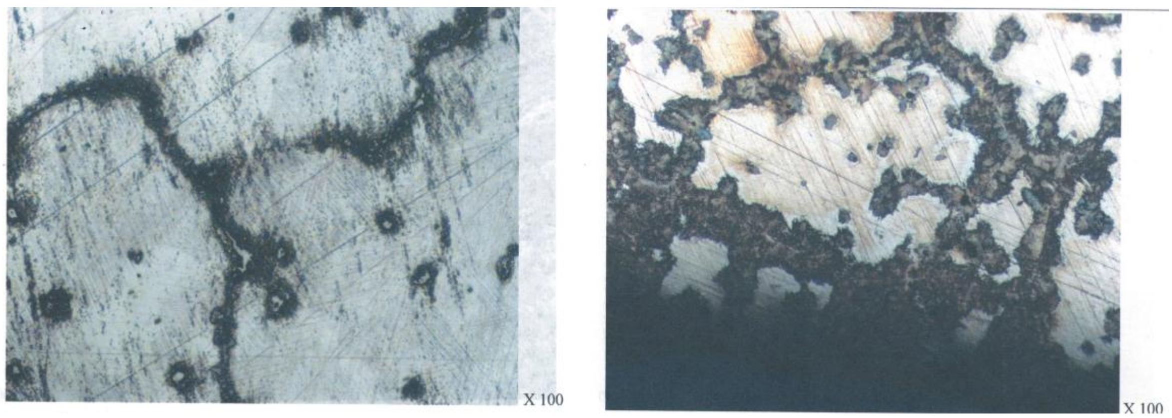


**Figure 2(a): Sample microstructure of Steel 65G. (a) Arrangement of austenite + trostite grains along the boundaries. (b) Location of cast carbide on surface.**

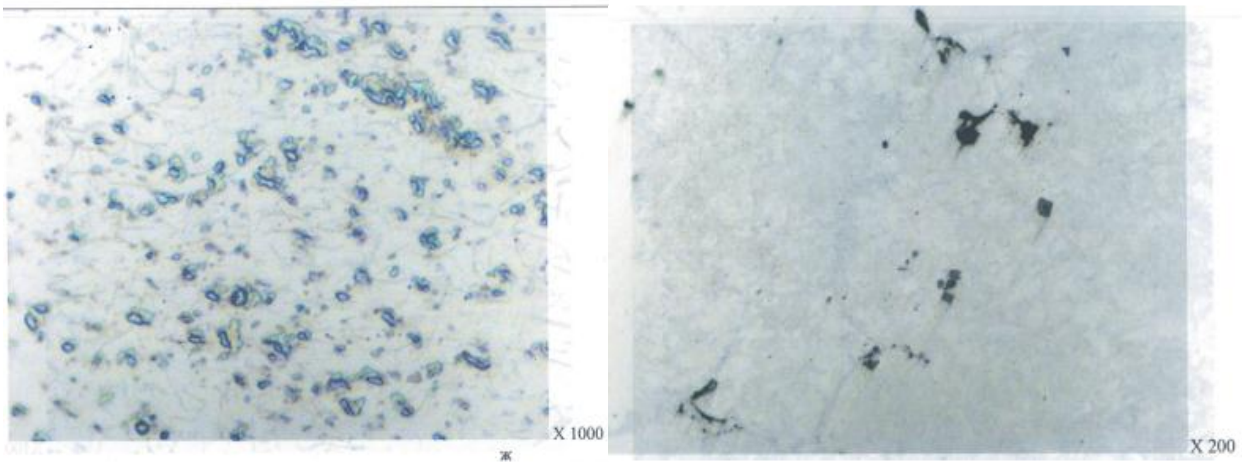


**Figure 2(b): Sample microstructure of Steel 65G. Location of manganese sulfides, oxysulfides, carbides, and gas pores in the alloy on the surface of the alloy.**

As can be seen from the microstructures, after adjusting the chemical composition of the alloy, the defects were somewhat reduced, and the absence of gas pores and non-metallic inclusions was significantly improved [4-5].

**Results**

Its optimal chemical composition was determined during the development of the technology of casting steel wheels working without shock loads. The required mechanical properties were achieved when the steel wheel part was cast according to the optimal chemical composition. In this case, due to the addition of aluminum in the amount of 0.1-0.3% of the ingot mass in the preheated cavity, the reduction of gas pores in the ingot was achieved due to the improvement of its fluidity and decrease in permeability. By changing the composition of the mold material, the gas permeability of the mold shape was improved, and internal and external cracks were not observed in the casting.

## Conclusion

- The technology of casting a steel wheel detail working without shock loads was developed.
- A new energy-saving technology of liquefaction of 65G carbon steel alloys
- was developed.
- The chemical composition of the alloy was corrected and carbon steel alloy samples were studied.
- Bentonite clay was used as a binder in the preparation of the mold, and it was found that the strength of the mold is improved if the working parts of the mold are covered with fireclay suspension and heated at a temperature of 400-500 ̊C for 2-4 hours.
- It was found that gas pores and mirror inclusions were reduced in the casting obtained on the basis of the developed technology.

## References

1. Bektemirov Abdujalol, Turakhodjaev Nodir, Mahmudov Fakhriddin, Tadjiev Nuriddin, Tashkhodjaeva Kamola, Sadikova Nargiza. / Development of steel wheel detail casting technology/ Asian Journal of Multidimensional Research ISSN: 2278-4853 Vol. 11, Issue 8, August 2022 SJIF 2022 = 8.179
2. Bektemirov A.D., Tashxodjayeva K.U., Erkinjonov A.B. “Uglerodli poʻlat qotishmasidan sifatli quyma mahsulotlar olish texnologiyasini ishlab chiqish” Mashonasozlik lmiy-texnik jurnali. ISSN 2181-1539. № 2. 2022 yil.
3. Xolmirzayev N.B, Sadikova N.I, Bekchanova V.B, Ermanov O.Sh, Turayev A.N.// 35ХГСЛ markali poʻlat qotishmasini suyuqlantirish texnologiyasini ishlab chiqish// ISSN 2181-1539. Машинасозлик илмий-техника журнали. №2, 2022 йил.
4. Turakhodjaev N.D. “Quality improvement of the steel melting technology in an electric arc furnace” ACADEMIA 2021.-T. 11.- № 7. – C.48-54.
5. Bektemirov A.D., Tashxodjayeva K.U., Erkinjonov A.B. “Uglerodli poʻlat qotishmasidan sifatli quyma mahsulotlar olish texnologiyasini ishlab chiqish” Mashonasozlik lmiy-texnik jurnali. ISSN 2181-1539. № 2. 2022 yil.