INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 4 Issue: 12 | December 2022

Improvement of Mold Material for Casting Thin-Walled Details from Gray Cast Iron

Jamshidbek Khasanov[1], Nodir Turakhodjaev[2], Fakhriddin Makhmudov[3]

[1]Ph.D researcher at Andijan Machine – Building Institute, Andijan, Uzbekistan

[2]DSc. professor at Tashkent State Technical University, Tashkent, Uzbekistan

[3]Assistant teacher at Tashkent State Technical University, Tashkent, Uzbekistan

----------***----------

Annotation: In this article, in the casting of thin-walled parts from gray cast iron, along with the mechanical, technological, physical properties of the mold material, it is important that the mold responds to technical and economic students.

Keywords: cast iron, gray cast iron, liquefaction, foundry, lifting roof, caolin, bentonite, graphite, model, sand – clay, mold, alloys.

INTRODUCTION

Thin – walled details are produced in various ways, their production in sand – clay molds is a complicated process In the field of casting, good fluidity of the alloy ensures good filling of the mold cavity and quality casting. Gray cast iron contains a large amount of carbon in the form of free graphite. The main reason why it is called gray cast iron is that when this type of cast iron is broken and the broken part is seen, the broken part appears gray due to reflection. Gray cast iron is also known as cast iron due to its high fluidity to the mold. In cast iron, graphite dampens vibrations well and is resistant to resonances. In addition, the high fluidity property of graphite cast iron makes it possible to obtain castings of various shapes [1 – 3]

MAIN PART

The mold material presented in the table below is obtained from kaolinite binder Al_2O_3, $2SiO_2$, $2H_2O$ minerals, which is used as mold clay in many foundry enterprises, its density is 2.58 – 2.60 g/cm^3 and the melting temperature is 1750 - 1790 ^oC and kaolin clay when heated to 100 – 140 ^oC, hygroscopic and 350 – 580 ^oC clay loses its moisture and turns into metakaolinite (Al_2O_3 * $2SiO_2$), in which the process of losing the binding properties of clay is called “liamotization of clay”. At 900 – 1050 ^oC, metakaolinite separates into amorphous components Al_2O_3 and SiO_2 – $3Al_2O_3$ $2SiO_2$ (mullite) is formed between 1280 ^oC. This component has no binding properties and is more of a refractory material, on the basis of the composition presented in the table 1 , the mold material for the lifting roof detail was prepared in the foundry mechanics workshop [4 – 6].

Table 1

Used sand, %	Quartz sand, %	Kaolin clay, %	Water, %
70 – 80	5 – 10	6– 8	3 – 7

The sand used as a mold material for casting thin-walled details from gray cast iron was mixed with 180 kg of 15 kg of quartz sand, 7 kg of kaolin clay, and 5 liters of water in a begun machine for 15 minutes. The gas permeability, consistency and moisture content of the prepared mixture were checked in the laboratory of the Mechanical workshop of O‘zmetkombinat JSC. In the laboratory samples taken from the begun machine 3 times and checked, the strength of the mixture was 0.47 – 0.49 kg/cm^2, gas permeability was 90%. Due to the thin – walled part of the raised shingle being poured, the strength of the mold is important in the process of pouring liquid alloy into the mold, and the high gas permeability ensures a quality casting. it was determined that the

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071

Volume: 4 Issue: 12 | December 2022

amount will decrease. Therefore, it was ensured that the amount of kaolin does not exceed 6 – 7 percent. The mold making process and the finished mold are shown in picture 1.1.

Picture 1. Sand clay mold using kaolin clay as a binder

The mold shown in picture 1 was cast using a sand-clay mold, and the irregularities on the surfaces of the thin-walled parts were caused by the incomplete release of gases from the liquid alloy. These defects damage the brittleness, corrosion resistance and corrosion resistance properties of the detail during processing.

Pic. 2. Defects observed in a thin-walled lifting roof detail cast using a sand-clay alloy with kaolin clay binder.

Picture 2 shows that the main reasons for the defects of the raised window detail in the prepared sand-clay mold are its low strength and low gas permeability. The composition was changed in order to increase the mechanical, physical, and technological properties of the mold material due to the fact that the observed defects damage the hardness, shrinkage resistance, and bending resistance properties of the detail, as well as damage its quality.

Bentonite clay was used as a binder in the preparation of the mold material in order to eliminate the above-mentioned defects and also to increase the hardness, corrosion resistance, mold filling and gas permeability properties of the cast part [7 – 8].

The main mineral of bentonite clay is montmorillonite ($Al_2O_3 * 4SiO_2 * nH_2O * mH_2O$), and P1T1 brand bentonite clay with a high fluidity level of 1600-1700 ^oC was used in accordance with the requirements specified in GOST 28177-89. The molding process for the preparation of the molds was carried out using the technological capabilities of the enterprise of the mixture in paired flasks by a pneumatic rammer. The molding density was 35-40 kgs/cm^2 and the amount of mixtures used in the molding process is given in table 2.

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071

Volume: 4 Issue: 12 | December 2022

Table 2

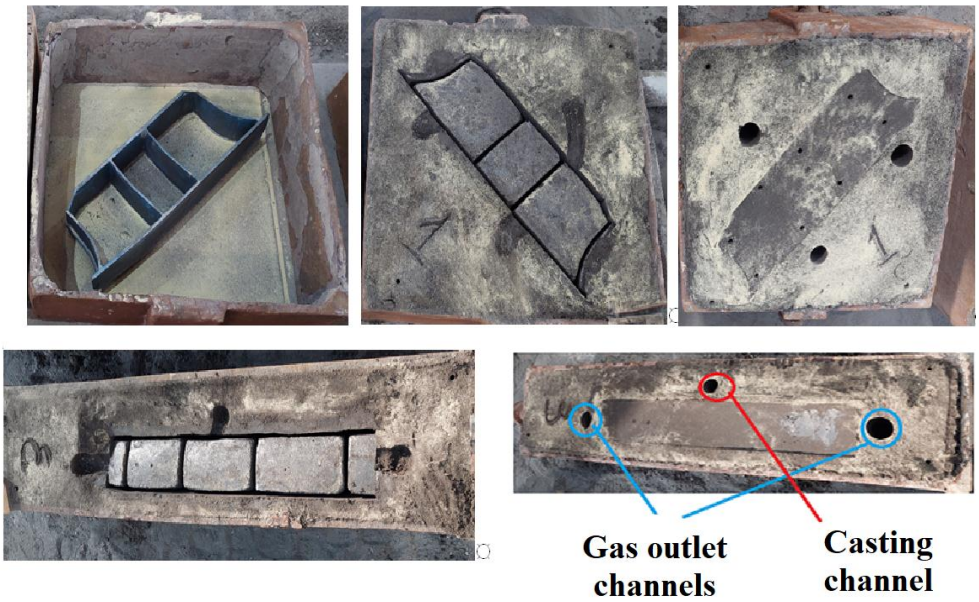
Used sand, %	Quartz sand, %	Bentonite %	Water, %	Anti-burn paint, mm	Mold drying ^{o}C	Mold holding time, hours
61 – 66	20 – 22	6 – 7	4 – 5	1-2 is applied to the inner surface of the mold	300	11

When bentonite clay is used as a binder in the mold mixture, it is a high-quality clay, (Al_2O_3 * $4SiO_2$ * H_2O+ H_2O) sand particles, not only on their surfaces, but also in their inner layers, have 2 – 3 more features than ordinary clays. It is known to be more than once.

Although quartz sand has a liquefaction temperature of 1750 – 1780 ^{o}C, when it is heated to 575 ^{o}C, due to the increase in volume due to its allotropic change, it saturates the mold material with dusty particles and its quality deteriorates. In order to restore the mechanical, physical and technological properties of the used quartz sand, during the preparation of the mold mixture, 20 – 22% was added to it during mixing in the begun machine. In order to ensure better bonding of bentonite clay with quartz sand, it was mixed with water and poured into the begun machine. During the mixing of the mold material, the bentonite solution was poured every 3 minutes in equal portions so that it would unite uniformly throughout the volume. Physical and mechanical properties of P1T1 bentonite clay according to GOST 322 – 93 P1 – fineness limit of 0.050 n/mm^2 when compressed wet, 0.32 n/mm^2 when dry, T1 - thermochemical resistance of 0.6, high-performance binder (not less than 0.0028 n/mm^2) is considered.

RESULTS

After mixing the mold mixture for 20 minutes, its strength, gas permeability, and moisture were checked in the express laboratory of the casting mechanics workshop. When the samples of the mixture taken in the laboratory were checked 3 times, the strength was 0.58 – 0.63 kg/cm^2, the gas permeability was 125 kN/m^2, and the moisture content was 4 – 6%. After mixing, the quartz sand used in the mold material contains stones and unmelted alloys, so it is called 0315; 025; 016 – size sieves, cleaned of extraneous large inclusions, loaded into the mold and ready-made molds are shown in Picture 3.



Pic. 3. Molds made using bentonite binding clay.

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 4 Issue: 12 | December 2022

CONCLUSIONS

Aluminum models were coated with graphite powder on their inner and outer surfaces in order to increase their quality and ease of removal from the mold before loading them into the mold. Compared to the model made from the mixture mixed with kaolin clay, the release from the mold made with bentonite clay was easier and faster. This is because the mold material mixed with bentonite clay is hardened after compaction in the ovens and does not compress the walls of the models.

REFERENCES

1. Mohd Moiz Khan, S.M.Mahajani, G.N.Jadhav "Transformation of bentonite used in green sand molds during metal casting process and its relevance in sand reclamation" Applied Clay Science Volume 206,1 June 2021, 106072
2. Vladimir Zivica, Martin T.Palo "Physico-chemical characterization of thermally treated bentonite" Composites Part B: Engineering Volume 68, January 2015, Pages 436-445
3. Mengya Zhang, Kexin Yi, Xiangwei Zhang, Peng Han, Wen Liu, Meiping Tong "Modification of zero valent iron nanoparticles by sodium alginate and bentonite: Enhanced transport, effective hexavalent chromium removal and reduced bacterial toxicity" Journal of Hazardous Materials Volume 388,15 April 2020, 121822
4. Schrems, K.K., Hawk, J.A., Do—an, _.N., Druschitz, A.P., "Statistical Analysis of the Mechanical Properties of Thin Walled Ductile Iron Castings," submitted to *SAE Transactions* (2003).
5. J.R. Grassi, J. Campbell, G.W. Kuhlman, Moldremoval casting method and apparatus (US 2007/7147031 B2, 2007
6. J. Campbell, Complete casting handbook: metal casting processes. Metall. Techniq. Design 2, 244 (2011
7. Turakhodjaev N. et al. Quality improvement of the steel melting technology in an electric arc furnace //ACADEMICIA: An International Multidisciplinary Research Journal. – 2021. – T. 11. – №. 7. – C. 48 – 54.
8. Turakhodjaev N. et al. An International Multidisciplinary Research Journal