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# FEATURES OF PRODUCTION PROCESSES BODY CASTINGS MADE OF HIGH-STRENGTH CAST IRON

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## ABOUT ARTICLE

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**Abstract:** In particular, the role of digital technologies in the educational sphere is special. The article provides feedback on the possibilities and importance of digital technologies in the organization of educational processes in the direction of technological education.

## INTRODUCTION

Modern mechanical engineering is characterized by a constant increase in the level of operating parameters and unit power of machines and aggregates, the use of high pressures, speeds and temperatures, which leads to stricter requirements for the physical and mechanical properties of alloys, among which high-strength cast iron is widely used. In recent years, the main requirements for metal products are such quality indicators as competitiveness, reliability and durability. Solving the problem of increasing the competitiveness and durability of machines, machine tools, pneumatic and hydraulic equipment of drives and other equipment in the conditions of intensification of production requires the use of structural materials with high physical, mechanical, technological and operational properties, which include high-strength cast iron with spherical and vermicular graphite shape (VChShG and VCHVG). The requirements for HSHG and HSHVG as structural materials are continuously increasing. In addition to strength, plasticity and hardness, mechanical properties such as fatigue resistance under dynamic and alternating loads are becoming increasingly important, impact strength and wear

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resistance. It is these mechanical characteristics that in some cases determine the choice of structural material for cast body parts of a responsible purpose and, accordingly, the technological process of casting production. The main feature of the production processes of many body castings is that it is necessary to provide them with optimal structural characteristics and physical and mechanical properties in massive and thin walls, without reducing the specified dimensional accuracy, geometric and technological rigidity. At the same time it is necessary to select such cooling conditions so that the massive walls of the castings have sufficient density, a given microstructure, there are no porosity, black spots, whiteness, piles, large residual stresses and cracks in thin walls. At the same time, there should be a high fluidity of the melt. This is the main contradiction in the manufacture of body castings, especially for metal-cutting machines, is solved almost individually for each responsible casting with the choice of the casting process and calculation optimal gate system, computer modeling of the casting process, selection and calculation of the charge, carrying out melting and manufacturing of an experimental batch of castings. An important feature of the process of manufacturing body castings is also the need to manufacture and install a large number of complex and massive rods in casting molds, install many dozens of foals, high melt overheating and fast pouring, as well as the use of other effective technological methods, operations and means of manufacturing molds, such as optimization of the chemical composition and physical condition of cast iron [1]. It is also important to take into account the factors regulating the cast structure [2], especially the degree of spheroidization of graphite (SSG) and the operations of refining, complex modification, inoculation, etc.[3]. It is known that in the manufacture of cast body parts, the chemical composition and mechanical properties of standard HSHGS are established in accordance with GOST 7293-85, 7769-82.

**Table 1. Classification of machine-tool castings made of high-strength cast iron.**

| Class | Group | Basic requirements for details | Typical representatives of the details | Perlite and graphite score according to GOST 3443-87 | Brand of cast iron |
|---|---|---|---|---|---|
| 1 | a | High Strength | Body parts of machines, gearboxes, machine tools and other equipment | P92 | custom cast iron **ВЧ45, ВЧ50** |
| 2 | b | Increased wear resistance | Tables, sleds, calipers, guides, etc. | **P70** | **custom cast iron ВЧ50, ВЧ60** |

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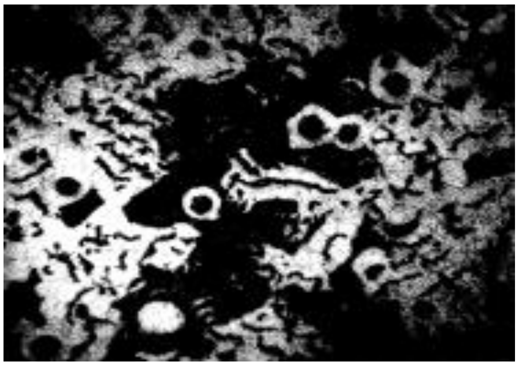
| | | | | | |
|---|---|---|---|---|---|
| 3 | c | Operation at pressures greater than 20 MPa | Spool housings and hydraulic pneumatic equipment of drives | **P70** | **custom cast iron ВЧ50, ВЧ60** |

Depending on the working conditions and purpose, the body and base cast parts of machine tools and mechanical engineering are divided into classes, and within classes - into groups. Table 1 shows the recommended grades of cast iron, typical representatives of cast machine tool parts and microstructure requirements in accordance with OST 2 MT29- 1-87. In heavy, transport, automotive, agricultural and other branches of mechanical engineering, the need for castings made of high-strength and high-trength castings is even greater, and the requirements for their structure and properties are higher. At the GLZ "Centrolit" mastered and applied technological rocesses of production of machine-tool castings of groups a, b and c of class 1, which are used in the cast state without additional heat treatment. The following technological methods and means are used in the manufacture of molds for machine tool and mechanical engineering body castings: installation of refrigerators, exothermic and modifying briquettes, feeding bosses, filter nets and filters made of foamed ceramics, alloying honeycomb and mesh inserts, special rods and harnesses. For the manufacture of individual critical castings, liquid self-hardening mixtures, shell molds, pulse molding, molding methods in rods and jackets, coquille casting and other special casting methods are also used. Especially high and stable physico-mechanical properties of the high-temperature furnace (a 5, KCU, wear resistance and density) are achieved during melting by the duplex process (induction crucible medium-frequency furnace with a capacity of Zt and induction mixer) using 15% refined pig iron and secondary charge materials when poured into shell molds and on an automatic pulse forming line. When its content in cast iron is 0.10% or more, not so much the modifying as the alloying effect of magnesium is manifested, as a result of which the carbon activity decreases, cast iron crystallizes with bleaching, the hardness of castings ncreases and their machinability by cutting worsens. Other effective imported modifiers (Elmag, Zircinoc, Barinoc, VL 63(M), MK 21, MKMr 19, etc.) and methods of introducing modifiers into casting buckets were also used. As a rule, in processes using insufficiently refined melts, the absorption of magnesium decreases, and the volume of slag and the release of smoke they are increasing. In addition, graphitizing modification of cast iron becomes more complicated. And, conversely, in processes with well-refined by you proceeding less intensively, the absorption of magnesium increases, the volume of slag decreases and the emission of smoke decreases. Also , very favorable conditions are being created for the secondary, graphitizing modification of cast iron. In experimental smelting, a fraction of modifiers from 0.8 to 4.0 mm was used to ensure rapid dissolution in cast iron and good flowability of the material during its dosing. Reliably eliminates the secondary modification of ferrosilicon FS75, which contains up to 4%

barium. Do not use silicocalcium it is recommended because of its poor solubility and digestibility in cast iron. The optimal dose of graphitizing modifiers is ~0.6%. When used in production conditions ferrosilicon FS45 its consumption is 0.34%. The yield of the good is 50.4%.



a b

**Fig 1. Cast iron electron-microscope view. 6000 times enlarged.**

A number of high-explosive compositions were smelted and samples were cast for mechanical tests, technological samples and body castings were made. Requirements for the chemical composition of the initial cast iron intended for processing on high-pressure, according to the main elements (carbon, silicon, manganese, sulfur), they were presented the same as in the production of HSHG. Unlike HSHG for HCV, there are less stringent requirements for the content of phosphorus, as well as titanium (up to 0.05% Ti). The structure of high-pressure castings made on an automatic pulse forming line usually contained 70% SHG and 30% VG, and the mechanical properties corresponded to the brand CHVG45. A sufficiently effective complex modifier [8] for spheroidizing processing VChShG and VCHVG are developed on Gomselmash software. The modifier contains 25-40% ferrosilicon FeSi75An, 25-40% dropout of the FSM-7 modifier according to TU 14-5-134-86 and crushed graphite - the rest. It is manufactured and used directly in the high-strength cast iron workshop of the plant for the manufacture of body parts of forage harvesters, which were previously made of ductile iron grades KCH35-10 and KCH37-12. The modifier provides high impact strength characteristics in castings (up to 11.2-18 J/cm2) and high dispersion of the structure. They are beginning to be used in high-speed friction mechanisms instead of antifriction cast irons ACV-1, ACK-1, ASF-1 and ASF-2 (GOST 1585-85), alloyed high-strength cast iron grades VCH70 and VCH80 (GOST 7298-85) and CHNMSH, CHNHT and CHNHMD (GOST 7769-82).

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