TYPES AND MARKING OF CAST IRON ALLOYS

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ABSTRACT

This scientific article describes cast iron, cast iron types, alloys and marking.

Cast iron is the most common non-carbon ferrous casting material, containing more than 2% carbon, up to 4.5% silicon, up to 1.5% manganese, up to 1.8% phosphorus, and 0.08% there is sulfur. In practice, cast irons with 3 ÷ 3.5% carbon are used.

Cast iron has high casting properties, so it is widely used as a structural material in the casting process. It is well processed by cutting. Normal bearings are made of cast iron with a low friction coefficient. In terms of quality indicators, specially processed cast iron (high strength) successfully competes with cast steel and forged steel.

Sufficient strength and high brittleness of cast iron is explained by the presence of large carbon inclusions in the form of graphite.

The addition of small amounts of magnesium and cerium to the molten iron changed the shape of the graphite, which became spherical. Cast iron gained strength and lost its brittleness. Such cast iron (it is called high strength) is not inferior in quality to structural carbon steels. The durability of these cast iron parts has increased almost three times.

Carbon in cast iron can be in the form of a chemical compound - cementite (such cast iron is called white) or in the form of graphite in a partially or completely free state - (such cast iron is called gray).

Cast iron consists of a metallic base (perlite, ferrite) and non-metallic inclusions of graphite. They differ mainly in the form of graphite inclusions. The use of white cast iron is limited. Some cast irons that require a stronger surface layer are made of bleached cast iron. Its surface layer consists of white cast iron and gray core. The size and hardness of the bleached layer is controlled by changing the chemical composition of the cast iron and the casting rate.

Gray cast iron

Gray cast iron is widely used in machine building. He got this name due to the gray color of the fracture due to the presence of free carbon in the form of graphite in the iron. By the appearance of the metal base, gray cast iron is pearlitic, pearlitic-ferritic and ferritic.

Graphite has low mechanical properties. This destroys the integrity of the metal base.

Graphite located between the grains of the metal base weakens the connection between them. Therefore, gray cast iron does not resist stretching and has very low ductility and hardness. The larger and simpler the graphite inclusions, the worse the mechanical properties of cast iron. The hardness of gray cast iron, as well as its resistance to compression, is steel, which has the same structure as the metal base of cast iron.

Graphite also has a certain positive effect on the properties of cast iron, in particular, it increases its wear resistance, acts in the same way as a lubricant, increases the ability to work by cutting, because it produces brittle chips, reduces product vibrations. dampens and reduces shrinkage in casting production.

The mechanical properties of gray cast iron can be improved by the uniform distribution of thin plate graphite in the casting. If additives are added to liquid cast iron before casting, they form additional centers of graphitization, resulting in the formation of thin plate graphite. It is called cast iron modified with such graphite. It differs from ordinary gray iron in its high tear resistance, but its ductility and adhesion are not improved in the modification.

According to GOST 1412-85, the letters MF in the designation of cast iron class are medium - gray cast iron. According to the index of tensile strength S limit or two-valued in MPa. Normalizes the tensile strength of standard gray cast irons 4 in = 274 ÷ 637 MPa, hardness - 143 ÷ 637 HB and chemical composition.

High-strength cast iron is achieved by adding magnesium (up to 0.9%) and cerium (up to 0.05%) to liquid gray cast iron before pouring it into molds. The main part of these modifiers evaporates, oxidizes and passes into the slag, so that more than 0.01% of these elements are absent in solid metals. Actively removes magnesium and cerium sulfur from cast iron. But their main role is to change the dark-colored candle form of graphite into a spherical one. After replacing the plate with magnesium or cerium, 75% ferrosilicon (iron alloy with silicon) is added. Unlike ductile iron, ductile iron is high in carbon and silicon and low in manganese.

The metal base of ductile iron consists of ferrite and pearlite or only pearlite. This cast iron combines the valuable properties of steel and cast iron. It has relatively high strength with sufficient flexibility and viscosity. High-strength cast iron successfully replaces steel castings and even cast steels, which provides great economic benefits. Due to its increased wear resistance, ductile iron products can work in frictional conditions. High-strength cast iron retains its strength when heated better than ash, so it can be used for work at temperatures up to 400 ° C (gray cast iron can withstand temperatures up to 250 ° C).

In GOST 7293-85 tensile strength s in the standard, yield stress s m ductile iron, cavity d and hardness HB. Casting requirements from these cast irons are established by normative and technical documents. The labeling principle of ductile iron (HF) differs from that of gray cast iron. Their brand contains two numbers - the first represents the tensile strength and the second - the elongation. For example, cast iron grade HF steel has a tensile strength s that means 42-12 = 412 N / mm 2 (42 kgs / mm 2) and elongation d = 12%.

The standard offers 10 brands of ductile iron: HF 38-17, HF 42-12, HF 45-5, HF 50-7, HF 50-2, HF 602, HF 70-2, HF 80-2, HF 100-2 , Treble 120-2. The standard or reference provides additional information about this cast iron: yield strength s t = 274 N / mm 2 (28 kgf / mm 2), hardness-140 ÷ 200 HB.

It is used for the manufacture of many parts (including formed parts) made of pre-finished steel (hubs and machine frames, large surfaces, sleeves, carriages, cylinders, brackets, gears,

machine guides and parts). hardened). They replace Steel 20L, 25L, ZOL and 35L.

Ductile iron contains graphite in a hardened form. Such graphite is called carbon softening. Compared with gray cast iron, cast iron has higher strength, ductility and hardness. It got its name because it increases flexibility. Forged iron is not used in the literal sense of the word.

The process of obtaining combustible iron ingots includes two stages: production of shaped ingots from white cast iron and softening of ingots for graphitization of cementite. During washing, white cast iron cementite breaks down and forms floccular graphite. As a result, a brittle and hard casting becomes more flexible and soft. Depending on the salt state and the mode of softening, the structure of cast iron can have a ferritic (F), pearlitic (P) and ferritic-pearlitic metallic base. The most common is ductile iron with ductile ferrite. Annealing of plate iron is a process that takes 70-80 hours, but it can be accelerated by casting from white cast iron before graphitizing, and by replacing the cast iron with aluminum, boron, bismuth or titanium. There are other ways to speed up the softening process. Using these methods can reduce the softening time to 35-40 hours.

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