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MAGNESIUM DISTRIBUTION IN SYNTHETIC HIGH-STRENGTH CAST-IRON

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Metallographic analysis, electron probe x-ray microanalysis and petrographic analysis of spherical graphite inclusions in cast iron produced using high purity charge materials were carried out. Magnesium being a base element is forming a spherical graphite shape in cast iron and is non-uniformly distributed between the metal substrate and the graphite phase was established.

Key words: synthetic cast-iron, spherical graphite, distribution, magnesium, oxygen

Forming of graphite in cast-irons remains the unsolved problem of materials technology and metallurgy and is based on a number of hypotheses. Most reasonable are hypotheses, that interpret forming is from the point of view of different speeds of increase of separate verges of graphite, condition forming lamellar, vermiculite or spherical form. This speed is determined by an internal structure and anisotropic of graphite, and also by influence of external factors, from which a most role is played by admixtures which sharply change faceting of crystals.

The purpose of this work was to set distribution of magnesium between a metallic matrix and graphite phase. For the removal of degree of influence for other factors on distribution of magnesium used burden materials of the increased cleanness on admixtures, first of all on sulphur and phosphorus.

Results of researches for distribution of elements - globulars, and in particular to magnesium, between a metallic matrix and graphite are very contradictory. It touches as more early [1-2], so later [3-6] researches. It can be interpreted by that the results of researches largely depend on perfection of the used methods, concentration of admixtures, structure of cast-iron and other factors. But, as a result of the limited solubility of magnesium in iron, its basic part must is in a graphite phase, In many works [1-4] a presence in the center of the graphite including of areas enriched was carbureted by magnesium. In other works [5-6] there are found, opposite, that external boundary of globule graphite is enriched by magnesium. Such ambiguousness was bound to formation of magnesium connections with other elements which are in cast-iron (by oxygen, sulphur) [1,2,4] by the concentration of magnesium between popular planes, in intercrystalline transitional areas which combine fragments to the graphite crystal [2-3] or by possibility of magnesium being in the vaporous state during the increase of globule graphite. Increased carbureted by magnesium of external boundary «globule-metal» is also interpreted by tearing away of magnesium from solution with fullerenes during crystallization of graphite [4]. Such distribution of magnesium is related to the new hypothesis of formation of spherical graphite as a result of existence of spherical fullerenes carbon [5].

As burden materials for the making of synthetic cast-iron there are used specially geared-up metallic bricks as cylinders by diameter 30 mm and in high 20 mm. Melting was executed in an open induction furnace from by the purpose-made graphite core in alumdum crucible by diameter 35 mm and in high 100 mm. For

leading to of composition of cast-iron after silicon used crystalline silicon. For the making of spherical graphite used nickel-magnesium ligature, that preliminary made from an electrolytic nickel and primary magnesium.

The samples of metal took away by means of quartz tubes by diameter 5 mm. Then there are from the selected samples made microsections for a metallographic analysis. Got metal had such chemical composition (the masses. part, %): 4.590 *C*; 2.480 *Si*; 0.920 *Ni*; 0.472 *Cu*; 0.042 *Mn*; 0.042 *Cr*; 0.040 % *Mg*; 0,.012 *P*; 0.005 *S*.

The metallographic analysis of samples of cast-iron was executed with the use of microscopes of MIM-7, Axiovert 200 M. A microroentgenspetral analysis it was carried out by means of electronic raster to the microscope of SUPRA 40 WDS.

Petrographic researches executed in the revolved light on the microscope of MBI-6 in magnification 90-1900 times. Extracting of inclusion of spherical graphite on the surface of microsection carried out by means of preparative needle on the stereoscopic microscope of MBS-2. Optical properties of the distinguished disseminations determined with the use of standard sets of immersion liquids on the crystaloptical microscope of MIN-8 in magnification 100-1000 times. In the communicating light there are determined a form, sizes and other properties of graphite inclusions.

Including of graphite was characterized by a large variety on form: next to an ordinary spherical graphite, it is looked exploded graphite also. Formations of such graphite often it is look on in cast-irons which were smelted from materials of charge of the increased cleanness. Treatment of cast-iron by nickel-magnesium ligature assisted crystallization on the metastable system. Round including of graphite looked after a shell which differed from a matrix.

It is set that distribution of magnesium on the structural constituents of cast-iron differs by some chaoticness: with the presence of concentration spikes both in a metallic matrix and in graphite globule. It is presumably related with high-rate of crystallization of samples of synthetic cast-iron (diameter 5.0 mm). Probably, magnesium which has a high cognation to oxygen and sulphur must contact with these elements at introduction in the liquid metal. But in the graphite including the concentration of oxygen and sulphur less, than in a metallic matrix.

For the exposure of micro distribution of these elements in graphite globule executed a local analysis. As set, silicon, nickel and copper, are situated mainly in a metallic matrix. Also sulphur is mainly located in a matrix; it is not educed in the graphite of its content. At the same time the presence of iron, oxygen and magnesium is educed in graphite.

For certain, at the conditions of oxygen deficit in cast-irons can appear metastable субоксіди of unstoichiometrical composition, first of all magnesium, and also calcium, silicon, iron and other elements. By additional petrographic researches for the graphite including are educe the presence of such connections.

It is set the special petrographic researches, that some aggregates of graphite, which were deleted from the metallic matrix of the experienced cast-iron, acquire magnetic properties. It can testify to co-operating of suboxides iron with the oxide of carbon. For certain, that suboxides iron, co-operating with the carbon oxide, also participate actively in forming of spherical form of graphite.

Conclusions. The executed researches allowed to set that magnesium, as an element – глобулярізатор, is unevenly distributed between metallic basis and graphite phase. Mainly, magnesium is situated in the graphite including and forms unstoichiometrical connections with oxygen.

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