UDC 669.111.2:669.162.624

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INFLUENCE OF SULPHUR IS ON MORPHOLOGY OF GRAPHITE IN CAST-IRONS

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It is set the petrographic and metallographic methods of research, that high maintenance of carbon and silicon is in cast-irons, and also their impoverished after oxygen, promote activity of sulphur, which can form connection with these elements and included in difficult hard solutions. In grey cast-irons sulphur represses superficial activity of monoxide of silicon, which is responsible for morphology of lamella graphite, and can distort his form, adsorbed on the surface of polycrystal disseminations. In high-strength cast-irons morphology of graphite is stipulated by the submagnox (Mg_2O) also impoverished after oxygen. Sulphur, in the case of her ultrahigh concentration (more than 0,02 %), will enter into co-operation, first of all with magnesium and to interfere with formation of monomagnox.

Keywords: cast-iron, sulphur, oxygen, morphology, dissemination of graphite

Introduction. In cast-irons sulphur is a surface-active admixture which substantially influences on morphology of graphite. At a negligible quantity (to 0.002 %) graphite appears shallow, interdendritic and even can be compact or spherical. On maintenance sulphur within the limits of 0.03-0.10 %, id est. when she usually meets in industrial grey cast-irons, the sizes of graphite increase, he becomes lamella, equipartition. During the ultrahigh concentration of sulphur lamella graphite degenerates on abnormal reticulated, compact or spherical graphite can appear again, but already in combination with carbides or in general can disappear fully.

Review of lit*erature and raising of task.* Sulphur without restriction dissolves in liquid and very small dissolves in hard iron. Character of distribution of sulphur is very contradictory and depends on many factors: chemical composition of cast-iron, speed of his cooling, terms of melting and other. It is experimentally set that sulphur mainly is situated on the limits of eutecticum grains and in graphite, although also can dissolve in an austenite and, especially, in cementite.

Experimentally set sulfides of a few types in the structure of grey cast-irons: those which are located after periphery of plates of graphite (type 1); those which are into plates (type 2); those, that compatible crystallizable with the plate of graphite (type 3) located alongside. Thus sulfides of type 1 more refractory and enriched by manganese, sulfides of types 2 and 3 poorer after manganese and enriched by iron [1].

During determination of influence of sulphur on the form of polycrystal disseminations of graphite consider that she is mainly adsorbed on his prismatic verges, almost stopping an increase after a thickness. As a result of this dissemination of graphite appears only lamella due to the height of mainly base plastins. Cleaning of verges of graphite by means of introduction of elements with a high cognation to these harmful admixtures, for example, of magnesium, cerium, etc., assists smoothing

of speed of increase of base and prismatic verges disseminations of graphite appear compact or even spherical.[2,3].

Confirmed thermodynamics calculations that morphology of graphite depends on activity of sulphur and oxygen. It is shown that at activity of sulphur and oxygen below $2.3 \cdot 10^{-3}$ and $3.0 \cdot 10^{-7}$ accordingly, a spherical graphite is created after retrofitting a cerium.

The special personal interest is caused by co-operating of sulphur with components of cast-iron and formation of oxisulfides disseminations or difficult sosoloids of variable composition [4], what undoubtedly influence on morphology of graphite during crystallization and hardening of cast-iron.

Purpose and task. In-process investigated influence of sulphur on morphology of graphite in cast-irons and the mechanism of her operating is pulled out on education and forming of graphite phase.

Materials and methods of researches. For research used grey and high-strength cast-irons which answered after chemical composition the brands of СЧ10 (SOU MPP 77.140.80-311:2009) and HF 500-2 (SSTC 3925-99). From the experienced cast-irons poured off standard tests for determination of properties and chemical composition, from which then prepared microsections for metallographic and petrographic studies.

The structure of cast-iron was investigated on the metallography microscopes of MIM-8M, Zeiss Axiovert 200 MAT. A micro x-ray spectral analysis was conducted by means of electronic raster to the microscope of SUPRA 40 WDS (Karl Zeiss).

Nature of graphite disseminations, their microstructure and morphology, was studied by metallography and petrographic methods with the additional use of microscopes of MIN-8 and MBI-6.

Results of researches. Realization of micro x-ray spectral analysis of grey cast-irons educed that sulphur mainly is a cut-in in a metallic matrix, and in graphite disseminations her concentration is considerably less and has very unstable chaotic character. In liquid cast-iron as a result of high maintenance of strong deoxidants (first of all, to silicon) there is a deficit of oxygen and conditions are hereupon created for the origin of oxides of mionectic valency.

Such sulfides of manganese have a regular crystalline shape (трьох-, чотирьох- or hexahedral). This reaction not always takes place to the end and her development depends on the physical and chemical terms of fusion.

An analogical picture is observed in industrial high-strength cast-irons. Sometimes a presence in the center of spherical disseminations of graphite of concentration peaks of magnesium and sulphur enables to consider that exactly sulfide of magnesium and is the embryo of spherical graphite. However the presence of the increased concentrations of magnesium and sulphur can be observed unnecessarily in the center of dissemination which was confirmed by us earlier [5,6].

Thus, not casting aside possibility of formation of graphite disseminations in cast-irons on the sulfides of manganese (in grey cast-irons) or magnesium (in high-strength cast-irons), it should be noted that such mechanism is not probable. The action of sulphur is analogical to the action of other superficial element - oxygen in

our view. So in grey cast-irons a leading role in forming of graphite is warmed by the monoxide of silicon (*SiO*), and sulphur at high concentrations represses its activity and diminishes ramified of lamella graphite.

In high-strength cast-irons, forming of spherical disseminations takes place also with participation of the surface-active monomagnox impoverished after oxygen. Sulphur in the case of its ultrahigh concentration (more than 0.02 %) will enter into co-operating first of all with magnesium and to interfere with formation of monomagnox.

Conclusions. It is set the conducted researches of grey and high-strength cast-irons, that sulphur is mainly distributed in a metallic matrix, forming not only connections with elements, to which has a high cognation, but also included in difficult hard solution on the basis of iron, silicon and oxygen. In grey cast-irons a leading role in forming of lamella disseminations is played by the surface-active monoxide of silicon. Activity of sulphur grows at presence of high maintenance of carbon and silicon, but she can form with them connections and to repress excrescence of plastins of graphite. In high-strength cast-irons morphology of graphite is stipulated by the monomagnox also impoverished after oxygen. Sulphur in the case of her ultrahigh concentration (more than 0.02 %) will enter into co-operating first of all with magnesium and to interfere with formation of monomagnox.

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