STRUCTURE AND PROPERTIES OF IRON ALLOYS WITH ULTRA-DISPERSED BY EDUCATIONS OF FREE CARBON

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Introduction

In the first message [1] the conditions of formation ultra-dispersed of particles of free carbon formed in iron-carbon alloys as a result of preliminary deformation, thermocycling with phase transformations of local partial melting by currents of high frequency and electric by an arch are considered. In pig-irons, modified magnesium, the carbon particles got a spherical kind, which sizes on one - two order exceeded carbon bulbs formed at annealing of diamond nanodusts [2]. From the investigated ways by most effective was partial melting by an electrical arch and HFC, due to which in an alloy up to 10^{11} см$^{-3}$ inclusions, removed from each other on distance close to a diameter of inclusions were formed. The basic purposes of the present research consist in perfection of a way based on local partial melting, in an establishment of the mechanism of formation ultra-dispersed of educations of free carbon, and also in definition of properties of the received materials.

Results and discussion

As against a technique given in job [3], in experiments widely used thermal processing's on isothermal or thermocyclic to a mode is accelerated cooled partial melted of samples. Due to this it was possible to increase to 10^{13} cm^{-3} number of particles of free carbon, having saved thus the spherical form. Ferritic a basis, which the alloys got after short-term annealing, dispersed, that testifies to the large influence of particles of free carbon on growth ferritic of a grain. Crushing of ferrite and fine allocation of free carbon positively have had an effect on microhardness partial melted of sites. After annealing it corresponded to hardness ferritic-pearlitic of pig-iron.

Thanks to the accelerated cooling partial melted of high-strength pig-iron near to the rests unsoluted of graphite are formed austenite-cementitic eutectic, and far from them, where has taken place complete partial melted, are formed and dendrites of superfluous austenite, between which branches is placed ledeburite and graphite (fig. 1a). The borders partial melted of a zone are determined by spatial orientation of the deformed graphite. The particles extended along a contact surface, limit distribution partial melted. If the initial particles are placed under a corner to a contact surface, partial melting is distributed far deep into of sample. In complication of a relief of front partial melting the large contribution brings in anisotropy of graphite, heat conduction which along basic planes in some times higher, than in a cross direction [4].

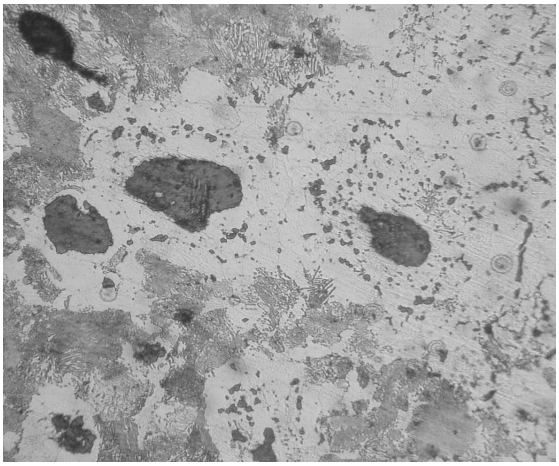
The intensive education precipitates of free carbon shown in great increase of number of particles promotes ferritization of a metal basis. By results of the theoretical analysis, the increase of number of particles in millions time reduces duration of disintegration cementite a hundred times. The experiments confirm this conclusion: 10 mines endurance partial melted of pig-iron at 850ºC has appeared sufficient for end graphitization, and the cooling in air up to room temperature gives to a metal matrix ferritic a state. Especially there are a lot of inclusions of free carbon is formed near to the rests unsoluted of graphite (fig. 1б). Decrease of the contents of carbon in connection with one more complete partial melting of pig-iron, and also the processes coagulation reduce number precipitates of free carbon up to 10^{10} см$^{-3}$ in the sites removed from deformed graphite.

At metallographic research of structure partial melted of sites 2 mechanisms of education of spherical particles of free carbon are revealed. In one of them, sold directly at the deformed graphite the formed particles became covered by a film austenite, that testifies to development abnormal eutectic crystallization. In other sites containing less of carbons and cooled less intensively, eutectic crystallization the education numerous dispersed dendrites austenite preceded. Crystallization of thin layers of smelt, placed between branches austenite, occurred to complete division of phases, that was described in job [5]. Thus eutectic austenite stratified on dendrites superfluous austenite, and the spherical inclusions of free carbon grew in smelt in absence austenitic of an environment. Because of high density graphite similar precipitates interdendrite sites are characterized by low mechanical properties.

On the basis of the received data the mechanism of formation ultra-dispersed of structures of free carbon in partial melted sites of the deformed high-strength pig-iron is analyzed.

According to results of accounts, quantity magnesium, allocated at partial melting of sites with the deformed graphite, it is enough for education numerous micro-bubbles, on which surface at cooling an alloy the free carbon is allocated. The covering is energetically justified by a film of carbon of a surface bubble, for conducts to decrease of superficial energy of iron [6]. On formation of structure partial melted of pig-iron the large influence is rendered by completeness of dissolution of the deformed graphite, rate of the subsequent cooling partial melted of sites, branching dendrites of superfluous austenite.

а)



б)

Figure 1 – Microstructure preliminary of deformed high-strength pig-iron after partial melted (a) and following annealing by 850ºC in the course 10min. x500 (b).

Meaning positive influence abnormal eutectic crystallization on structure and the properties partial melted of sites, in the report are given the recommendations at the choice of technological parameters of processing of the deformed high-strength pig-iron.

Conclusions

1. The thermal processing with partial melting and subsequent annealing of the deformed high-strength pig-iron increases number of particles of free carbon up to 10^{13} $см^{-3}$.

2. The increase of number of spherical particles of free carbon is connected to education bubbles gaseous magnesium, transited in smelt at dissolution of the deformed graphite.

3. The education of spherical graphite at eutectic crystallization partial melted of sites occurs by complete division of phases or is accompanied by education austenitic of an environment.

4. In both cases the origin of spherical carbon particles is caused by decrease of superficial energy in connection with a covering by carbon of a surface bubbles of magnesium.

Rreferences

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