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TECHNOLOGY OF RECEIPT AND OFFICIAL PROPERTIES FOR TERMITE STEEL 20

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The technology of termite steel of receipt, which is analogue for industrial steel 20 was analyzed in the paper. It is researched the termite steel, its chemical composition, structure features, mechanical and service properties. The changes of mechanical properties from the temperature have revealed. Dependence of ductility on the duration and temperature of tests is set. At the making of termite steel main advantages metallotermic synthesis are used. The engineering technology of synthesis can be used at special welding of blanks and mending of parts.

Keywords: termite steel, synthesis, metallotermic charge, properties, termite melting

Structural steels are widely used in the practice of engineering production. One of the most typical of this class of steel is steel 20, which has a wide range of technological and service properties. Structural steel of specified mark is used at power engineering industry for details operating at temperatures of 400-450 °C. Higher temperature of operation details of this alloy leads to graphitization of steel, and the degree of graphitization depends also at the degree desalted, method of deoxidation, the chemical composition of steel.

Metallotermic methods of obtaining alloys in the last century also known. Share of them is based at the classic thermite reaction [1,2]. Despite the fact that the technology of synthesis of alloys based on thermite reactions there are obtained blanks and parts are more expensive than with ordinary industrial technology, under certain circumstances they become economically viable. It should only take advantage of such technologies, namely high performance, versatility and autonomy (their implementation does not require large power source, no need sophisticated foundry equipment), not least important, and little time to implement technology in the production of and others.

All of the above set of scientific and technical problem, which is to establish possible synthesis method of termite carbon steel and the investigation its technological and service properties and use of material for specific details of power engineering and its repair.

Installation of mechanical properties at different temperatures and depending of identify plasticity thermite steel of the duration and temperature test as well as relaxed stability studies at certain temperatures was investigated.

Materials used for build metallotermic mixtures: ferrochrome «FCh65-7A» GOST 47570-79, sylikomanganes «SiMn26» GOST 4756-77, ferrosilicon «FeSi65Al35» GOST 1415-78, aluminium powder brands «PA-3…PA-4» GOST 6058-73 and sifted grinding of aluminium chips, ferromanganese «FeMn70» GOST 4761-80, iron slag (forging and rolling mills) with an average chemical composition (% wt): 0.05 *C*, 0.10-0.35 *Si*; 0.10-0.35 *Mn*; 0.01…0.03 *S*; 0.01-0.03 *P*; 40-50 Fe_2O_3; 50-60 *FeO* and others.

To determine the mass of the metal ingot and output for metal of the charge carried mikromelting with a mass 300 g metallotermic reactor with diameter 80 mm with varying percentages of components in the mixture are carried out. Initiation of burning process was carried out with use special titanium fervour.

Charge preliminary calculated by the stoichiometric correlation of reaction components [3] and subsequently its composition corrected using absorption coefficients of reaction components. Powder charge preliminary stirred at a temperature of 150-180 °C, and compact, and then placed in the upper chamber metallotermic reactor [4,5]. To improved slag removal in charge was added feldspar (CaF_2). After melting the alloy was separated from the slag, evaluating structure of slag and it is carried out control weighting and synthesized ingot is investigated. The third stage investigations [6,7] was to correct the charge by making appropriate inert impurities.

After setting the composition of charge for stoichiometric stirred of chemical reaction and correction it by absorption coefficients of mixture components, the calculation of adiabatic combustion temperature was performed. When the calculation according to the existing methods it was not take into account the sublimation of aluminium, which makes it an insignificant error setting the adiabatic temperature (T_a) and heat for formation of the reaction products (Q). The main criterion for obtaining ingots T_a should be for all reactions above the melting temperature of the reaction products (T_{melt}). Calculation does not include heat in the combustion process and complete conversion of reactants in the reaction products. In simplified calculations T_a was determined without regard to the exact values of heats and thermal effect set at medium temperature (eg, 2500 K). Change by the thermal effect when the reaction products are in liquid form, can be neglected.

We know that good desalted industry steel has become more prone to graphitization than half calm or boiling. The same situation arises with the additional excess powder aluminium from charge. As a result of experimental work was revealed that thermite steel 20 starts noticeably graphitization over 10.000 hours. Especially, these processes occur in zone near the weld after thermite welding, exactly where temperature thermite zone of influence is more than 500…700 °C.

Another of feature metallotermic synthesis is a high temperature in the reaction zone of the reaction components. At using two-chamber design of metallotermic reactor the duration of exposure for the liquid melt in the lower chamber increases, which significantly contributes roundforms synthesized carbides. Influence of these two processes takes place simultaneously during solidification and cooling termite steel, has result to reduction of its strength, ductility and toughness. The structure of the invest-tigated steel consists from ferrite and pearlier separate zones of different density. Only upon receipt of castings in the chills zone under the crust observed martensitic structure type.

Experimental studies have revealed the dependence of ductility from the duration and time of testing for thermite carbon steel containing 0.18 % *C*, 0.50 % *Mn*, 0.70 % *Si*, 0.05 % *P* and 0.05 *S* at temperatures 550-600 and 650 °C.

The values of the mechanical properties for thermite steel 20 depending from the test temperature is reduced: at a temperature 450 °C σ_{10^4} = 60 MPa, σ_{10^5} = 85 MPa, and a temperature at 500 °C – σ_{10^4} = 3.2 MPa, σ_{10^5} = 6.9 MPa, respectively.

The continuation of experimental researches was aimed at establishing relaxation resistance steel – an analogue of the chemical composition of industrial steel 20 at temperature 400 and 500 °C.

Analysis of changes for mechanical properties depending on temperature and relaxation stability study thermite steel, when compared with industrial properties show that metallotermic method of producing a positive impact on thermite steel 20. The properties of the steel were not worse, and flexibility depending from the duration and temperature of the test were even on 9.5-15.0 % better.

Equally important is the fact that the technology of synthesis of thermite steel can be successfully used at emergency welding work pieces using metallotermic pastes and repair parts.

Conclusions. Mechanical and service properties for thermite steel (analogue industrial steel 20), were studied namely the change in mechanical properties determined from the temperature, dependence of ductility from the duration and temperature tests. The peculiarities of thermite steel structures, including the effects of metallotermic method of synthesis of alloy to graphitization processes and the formation and distribution of carbides in the thermite steel.

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