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TECHNOLOGY FOR RECEIPT OF THERMITE STEEL 70L

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It is investigated thermite steel 70Л in this work. The features of chemical composition, physical and mechanical properties of thermite steel are educed. The change of mechanical properties of thermite steel of 70Л is educed by separate researches at subzero temperatures. The conducted work was allowed to as-certain composition of charge for the synthesis of thermite steel 70Л, to work out the methods for preparation of metallothermy mixture and synthesis of alloy.

Key words: thermit, thermite alloys, metallothermy, steel 70Л, charge, pro-perties

Possibility of mending for large details by the methods of metallothermy always demend of careful approach, both to the synthesis of thermite material and to establishment of it properties, structure, technological receptions, using the methods of the thermite welding and renewal of threadbare surfaces of details. Just the same hard requirements set the problem on establishment of properties for thermite steel 70L, most often applied for making of responsibility large details.

As is generally known the thermite methods of synthesis have substantial advantages which allow effectively to use them in the conditions of single and small-serial production. It, foremost, autonomy for process of synthesis, simplicity and cheapness of technological equipment, high productivity, possibility to organize a synthesis in the unspecialized workshops and even in the field conditions [1-4].

For today the improvement of materials properties is arrived at mainly by the use of traditional technologies of their receipt and subsequent thermal, chemical-thermal and another ways of treatment. But their high duty, necessity of combination of a few technological stages, an observance over of ecological requirements are brought to the necessity of search of other ways of receipt for necessary properties of materials and to the synthesis of new materials, sometimes with unique properties which allow to avoid the indicated defects. One of such perspective ways of search for technologies of materials synthesis can be the use, offered in this work, method of receipt of steels with the use of strongly exothermal reactions worked out in theory and experimentally reasonable.

Thus, at making and for a mending molded details from steel 70L there is possibility to use thermite methods which find all greater distribution lately.

At arrange metallothermic charge next materials were used: chrome metallic (ГОСТ 5905-79); ferrochromium FC65-7A (ГОСТ 47570-79); silico-calcium S40Л10 (ГОСТ 4762-71); aluminium for desoxydating and aluminothermy A-897 (ГОСТ 295-79); silicomanganese SMn26 (ГОСТ 4756-77); ferrosilicon FS65Al3,5 (ГОСТ 1415-78); powder aluminium PA-3-PA-6 (ГОСТ 6058-73); ferromanganese FMn70 (ГОСТ 4761-80); carbon black acetylene (technical carbon (ТС 14-7-24-80) titanic chemical powder PTC-1 (ТС 48-10-78-83); chrome powder PCX-1 (ТС 14-1-14-77-75); ferrous dross (forge and rolling productions) of middle chemical composition (% mas.): 50-60 *FeO*; 40-50 Fe_2O_3; 0.10-0.35 *Si*; 0.10-0.35 *Mn*; 0.05 *C*; 0.01-

0.03 *S*; 0.01-0.03 *P*.

For determination of mass of metallic bar and output of metal from a charge, nicrofusions were executed in metallothermic reactor by a diameter a 80 mm with different percent correlation of components in mixture [5].

The process of thermite synthesis consists in arrange from powder ingredients of metallothermic charge on the basis of reaction of renewal of iron from a dross by aluminium. A ferrous dross is exposed to the preliminary drying out at temperature 150-200 °C, and if necessary and burning at a temperature 350-400 °C. From initial powder materials - ingredients of chemical reaction - arrange a metallothermic charge. A charge was expected in a few stages. After establishment of adiabatic temperature of burning, which must be more temperature for division of thermite alloy and slag phase, composition of mixture on stoichiometrical correlations of components of reaction determined. On the next stage composition of charge was corrected by the coefficients for mastering of components.

At initiation of reaction by thermite match there is a process of burning which high temperature fusion of thermite steel 70L appears as a result. Adiabatic temperature of burning of metallothermic charge taking into account additional components which improve the process of synthesis and alagging (feldspar CaF_2, sifted beaten glass and other) was within the limits 1450-1830 °C.

Methods of thermo-chemical calculations. After establishment of charge composition on the stoichiometrical coefficients of chemical reaction and correction of it by coefficients mastering of components of charge, the calculation of adiabatic temperature of burning executed [13]. During realization of calculations with use of worked out methods did not take into account the sublimation of aluminium, that gives an unimportant error at establishment of adiabatic temperature (T_a) and warmth of formation for foods of reaction (Q). A basic criterion of receipt of alloy is a temperature T_a for all reactions must be higher than temperature of melting for foods of reaction (T_{mel}). A calculation T_a does not take into account thermal losses in the process of burning and plenitude of transformation of reagents in foods of reaction. On the simplified scheme of calculation T_a determined without the account of the exact meaning of heat capacities, and a thermal effect was set at a middle temperature (for example, 2230 °C). By the change of thermal effect, at being of foods of reaction it is possible to scorn in the liquid state.

Experimental researches. As a result of realization of the experimental melting in experienced-industrial conditions got six casting of wheels from thermite steel 70L with mass 50 kg. The results of chemical analysis of the synthesized thermite steel showed irrebevant departure of it composition from industrial, that confirms the rightness of thermo-chemical calculations.

Mechanical tests were executed on wedge poors, intagliated from the experimental cast billets. As a result of researches it is set, that mechanical properties of thermite steel 70L better than properties of industrial steel on 7-11 %. Obviously it is related to deoxidization of thermite steel by an aluminium which enters in the composition of charge.

The study of castings properties of thermite steel showed that a size of free shrinkage was within the limits of 1.8-2.3 % depending on mass of casting. It is

educed also, that steel of 70L small feels a firecracking during testing on U-tupe tests.

Separate direction of research was establishment of shock viscidity of thermite steel at subzero temperatures.

Shock viscidity of thermite steel substantially decrease (almost in 1.6 time) at a drop in a temperature from +20 to -60 °C. Analogical results for industrial steels caharterized by diminishing ан almost in 2.1 time at the absolute value of their values almost on 50 % less than, and the also comparisons of data at a temperature 60 °C - on 100 % less than.

Perspective is continuation of these researches at research of properties of thermite wheels and at fusing steel on metallic basis.

Conclusions.

1. As a result of the executed researches composition of metallothermy charge for the synthesis of thermite steel 70L set and features of chemical composition of the synthesized thermite steel 70L.

2. Technology of thermite synthesis of alloy is worked out and foundings are got the ко-лес from steel 70L.

3. The mechanical and some technological properties of thermite steel are investigated. It is thus set that it mechanical properties on 7-11 % better, and castings properties not worse, than for an industrial analogue. By researches shock viscidity of thermite steel at subzero temperatures is educed, that iy values on 50-100 % are higher, than at a single industrial alloy.

4. Perspective directions of continuation of research for thermite steel and it is educed most expedient application.

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