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RESEARCH OF INFLUENCE OF TEMPERATURE OF THERMAL TREATMENT AND COMPOSITION OF CHARGE ON DENSITY OF METALLIZED VANADIUMCONTAINING MATERIAL

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There are investigated phase and structural transformations at the process of carbothermic recovery of vanadium pentaoxide (V_2O_5). It is carried out studying of agency of temperatures of thermal treatment and composition of charge at process carbothermic recoveries of samples on a basis V_2O_5 on the change of their density.

Keywords: vanadium pentaoxide, carbothermic restoration, phase and structural transformations, degree of restoration, density

Introduction. Accumulated experience of utilization of refractory elements from metal-oxide technogenic wastes instrumental alloyed and high-speed steels as charge addition preliminary moralized performs differs in high efficiency and perspective of the chosen direction confirms [1,2]. Some analogies at renewal of oxides of molybdenum and tungsten by a carbon in the systems without appearance of liquid phases traced at compared with renewal of vanadium oxides [3-5], however for achievement of technological completeness the results of deeper researches of renewal of vanadium oxides in the heterogeneous system are needed.

Broblem formulation. The purpose of the real work is a study of influence of temperature of thermal treatment and composition of charge at carbothermic renewal of samples on the basis of V_2O_5 on the change of their closeness.

Exposition of basic material. Samples subjected by isothermal thermal treatment at temperatures 1073-1473 K during 1.0 hour. As a initial materials used technically clean pentaoxide vanadium with additions of graphite as a cyclone dust (correlation O/C = 1.33) and binder (resin ТУ 38-10916-79). For approaching of composition of samples to chemical and mineralogical composition of ore raw material charge components are choosed allowing to regulate concomitant oxide impurities, being in ore raw material, one of which is a flux АН-295 (ТУ 5929-004-05764417-2003). At renewal of samples there is controlled the decrease of there mass and change of their linear sizes (closeness's).

Phase composition of vanadium containing samples was investigated on the diffractometer of DRON-6 in the radiation of copper cathode with a nickeliferous filter on methods, described in work [6]. X-rayctructure analysis was executed with the use of complex of the programs of PDWin 2.0 and additional reference literature [7,8]. The microstructure of samples was studied on raster electronic microscope JSM 6360LA on the methods of work [9].

Industrial testing of carbothermic and combined renewal of charge performs [10] showed that the increase of linear sizes of samples is useful only in certain limits, meeting the requirements of technological process and fullness at mastering of elements from the got material. It is thus necessary to take into account the decline of heat conductivity of samples and sintering of particles of recoverable material.

The process of renewal of metals oxides foresees delivery of repairer to the oxide, chemical reaction of repairer with oxygen of oxide, formation of new phase with a peculiar to its crystalline grate, diffusive moving of particles through the layer of products of reaction, chemical reactions on the borders of division old and new phases [11]. Therefore, the mechanism of height of samples must be examined in close connection with the processes of renewal.

From a fig. 1, fellow, that vanadium containing samples, recovered at a temperature 1073 K, have a less closeness, what initial samples. It is also confirmed by the charts of fig. 1.б, which specify on the increase of intensity of decrease of mass for samples at a temperature 1073 K as compared to the row of samples, recovered at a temperature 1173 K. Restoration processes at a temperature 1073 K are poorly activated and presented, mainly, by the transition of V_2O_5 in V_2O_3.

Increase of temperature to 1173 K accompanied by the further lowering of closeness of most samples, by development of processes of gasification binder, carbon and renewal of V_2O_5 to V_2O_3 with appearance of small part VC. Judging on the structure of the recovered sample at a temperature 1073 K, the particles of oxides have the stratified loose structure, hampering sintering, and diffusive processes did not arrive at sufficient intensity of flowing (fig. 2.б). Thus takes place decline of speed for loss of mass for some samples, that it can be explained by both formation of block-layers, closing part pores and hampering taking gaseous products of reaction and initial stages of formation of oxicarbides and carbides.

At the increase of temperature to 1273 K there is simultaneous increase closenesses of samples and growth of speed of decrease of mass (fig. 1). From one side, it testifies about activating of restoration processes (fig. 2,a) with formation of VC, and, with other, it specifies on activation of diffusive processes with predominance of sintering and compression of samples above the increase of their linear sizes at content the 5-30 % masses АН-295. With the increase of temperature of carbothermic renewal to 1373 K it is educed the decline of compression speed for samples with the simultaneous substantial increase of loss of their mass. In such conditions development of carburization is educed with formation of VC (fig. 2.а).

The increase of content of flux АН-295 in samples results to the increase of seating of sintering of his particles capacity. There is formation of cake-on block-layers flux with placing between them particles of the recovered phases, the diffusive processes of masstransfer and gas exchange, concomitant to the increase of size samples, have difficulty here.

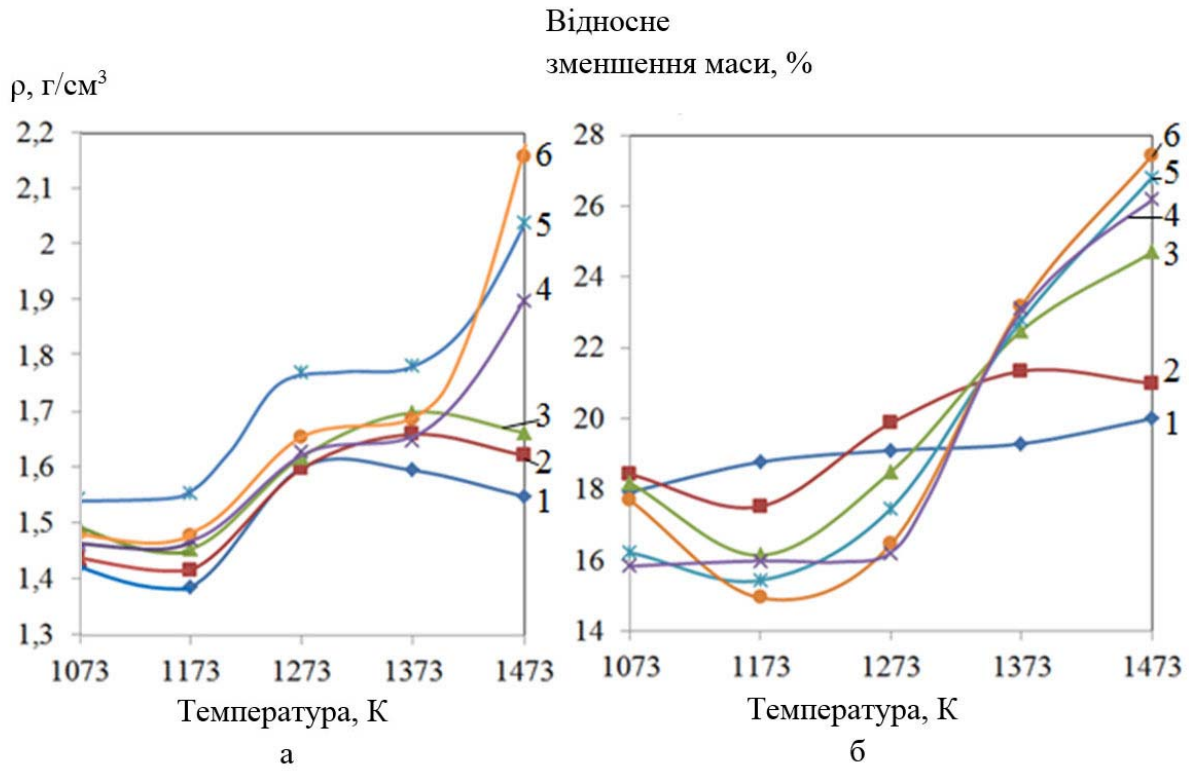

Figure 1 - Dependence of closeness (a) and change of mass (b) of recovered by carbothermic method of vanadium containing samples on the basis V2O5 from the temperature of process with addition of AH-295: 1 - 5 %; 2 - 10 %; 3 - 15 %; 4 - 20 %; 5 - 25 %; 6 - 30 %

In all investigated interval of temperature there is educed conformity to law of increase of closeness of samples at the increase of content of flux AH-295. So, at content of flux of 5.15 % mass it is the activator of increase of linear sizes of sample that hampers sintering of the recovered particles, but not diffusion. At its content more than 15 % there is formation of cake-on block-layers AH-295, which is accompanied by braking of processes of gas- and masstransfer. Presence of more intensive decline of mass at temperatures 107-1273 K in samples with more subzero content of AH-295 evidently on a fig. 1. With the increase of temperature higher 1273 K in samples with high content of flux the height of decrease of mass is educed. It is explained by that at temperatures 1073-1273 K additions of flux serve as an additional restriction on the way of products of gasification of carbon and binder, slowing down decrease of mass, and at temperatures 1273-1473 K and content of flux more than 15 % mass more dense structure is provided, a contact between particles gets better, that results in activation of reactions of renewal and decrease of mass from formation of gaseous products of reaction CO and CO_2.

Higher location a curve 5 sample on a fig. 1 at content of flux 25 % mass is possible to explain formation of joint connection of oxides of vanadium and constituents of flux. Thus addition of 25 % mass flux enables formation of maximal quantity of this connection which, presumably, creates more favorable conditions for sintering of particles of samples. By one of causes of decrease of mass of samples on all investigated temperature interval at its heating it is the sublimation of vanadium oxide

(V_2O_5) serves which in these conditions has a high resiliency of steams [12].

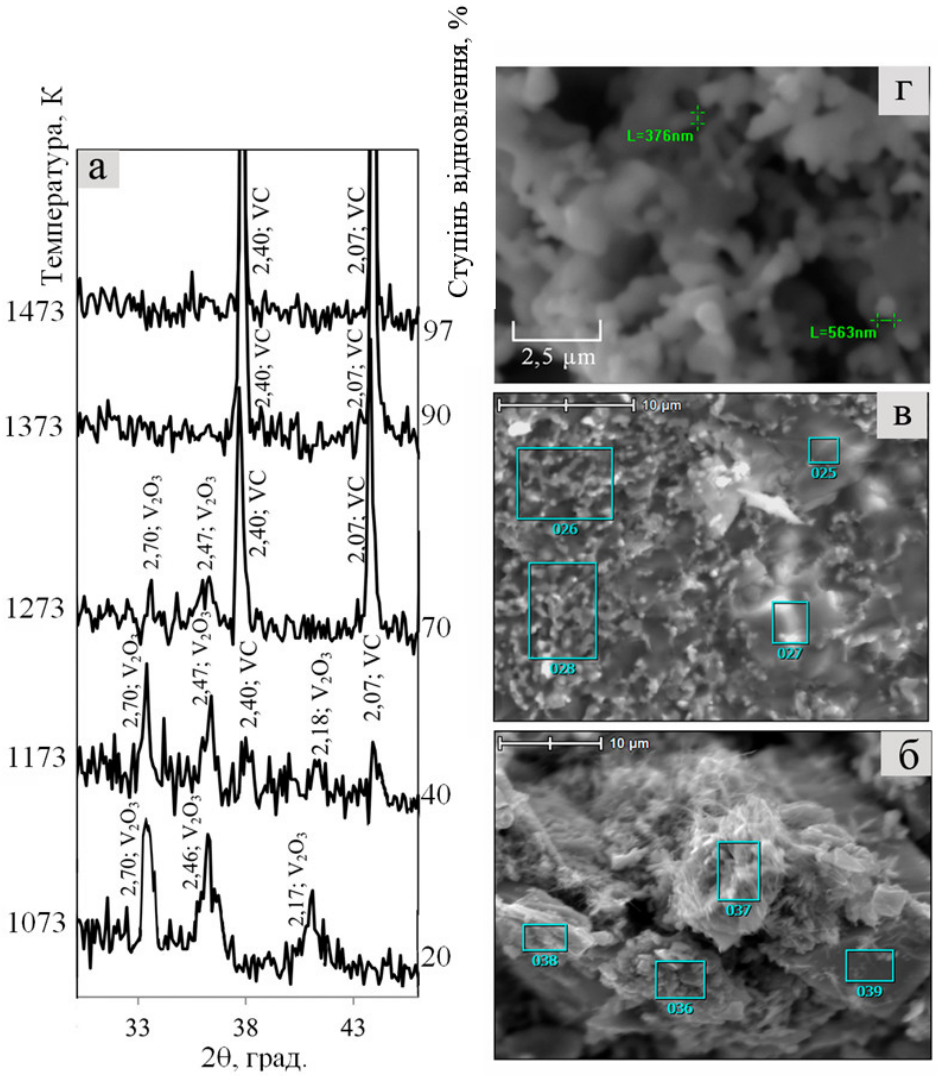

Figure 2 - Area of diffractograms (a) and fractograph vanadium containing samples on the basis of V_2O_5 with content of 15 % mass flux of AH-295 after carbothermic renewals at temperature: б - 1073 K; in - 1273 K; g - 1473 K with the increase of x3000 (б), x4000 (в), 5000 (г) recovered

In productive terms there is set [13], that at smelting of steel Р6М5Ф3-МП addition of new alloying material 45-70 kg/t on the basis of dross of high-speed steel results to the decline of chrome expense on 2-3 %, molybdenum expense - on 3-4 %, tungsten expense - on 30-36 % and vanadium expense - on 7-8 %.

Conclusions. There are educed features of change of closeness for vanadium containing tablets on the basis V_2O_5 at their carbothermic renewal in a temperature interval 1073-1473 K at content in them flux of AH-295 in an quantity from 5 to 30 % mass. It is certain that additions of AH-295 in an quantity 5-10 % mass hamper sintering of the recovered particles. And at content AH-295 higher 10 % mass more dense structure of products of renewal is provided due to the best contact between the particles of flux and their sintering. It results in development of reactions of renewal and decrease of mass samples.

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