NITRIDING OF MECHANICALLY PRE-ACTIVATED FERROCHROMALUMINIUM IN THE COMBUSTION MODE*

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At present, nitrides are of particular interest due to their unique physical and chemical properties. The cost of production of nitrides can be significantly reduced if ferroalloys will be used as precursors, which are relatively cheap high-tonnage materials [1]. In our opinion, the most promising method for producing nitrides is the method of filtration self-propagating high-temperature synthesis (SHS) [2]. One of the ways to control the combustion conditions of powders is the mechanical activation of a reaction mixture [3,4].

In this work, the effect of mechanical activation on nitriding of a complex ferroalloy (ferrochromaluminium) was studied.

Ferrochromaluminium (FCA) represented by the phases such as AlFe, Cr and $AlFeCr_2$ was chosen as the starting material. According to the chemical analysis, the ferroalloy contained 6.4% aluminum, 32.6% iron and 61.0% chromium.

The phase composition was determined on a Shimadzu XRD6000 diffractometer (Japan). The content of nitrogen and oxygen was determined on a LECO-ONH836 (United States) analyzer at the Tomsk Regional Center for Collective Use, TSC SB RAS. The starting powders were mechanically activated in an APF-5 planetary mill with a centrifugal force of 60 g.

In the work, the effect of mechanical pre-activation on the nitriding parameters of ferrochromaluminum was studied varying the diameter of the sample (Fig. 1) and the nitrogen pressure (Fig. 2). The use of mechanically processed starting powder in SHS reactions expands the limits for the initiation of combustion reactions from P = 0.02 MPa and D = 20 mm, as well as increases the amount of absorbed nitrogen in products up to 13.6% and the combustion rate.

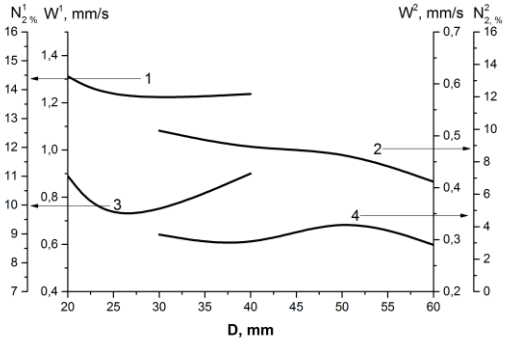

Figure 1. Nitrogen content (N^1-activated powder (1),N^2- unactivated powder (2)) and combustion rate (W^1-activated powder (3), W^2-unactivated powder (4)) as a function of the diameter of the FCA samples.

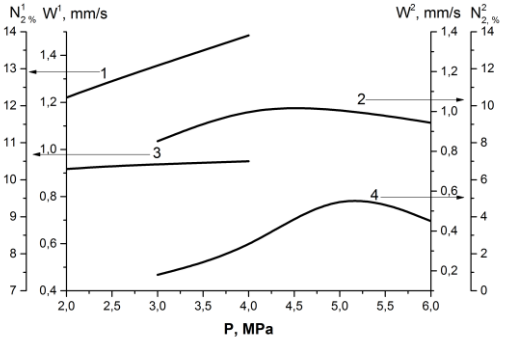

Figure 2. Nitrogen content (N^1-activated powder (1),N^2- unactivated powder (2)) and combustion rate (W^1-activated powder (3), W^2-unactivated powder (4)) as a function of the nitrogen pressure.

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