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SHS SYSTEM "TI-CO-N": THE MECHANISM OF PHASE FORMATION AND THE ROLE OF INTERMEDIATE PHASES*

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The self-propagating high-temperature synthesis (SHS) of the TI-Co-N system was investigated and the relationship of combustion parameters, the state diagram, the mechanism of phase formation and the role of intermediate phases of nitrides in this is found. Combustion system parameters were studied under various initial conditions that characterize the behavior of a high-temperature chemically active solid-liquid medium. The zone of chemical reactions for combustion is a solid-liquid melt, with nitrogen gas enters, corresponding to the melt solidus-liquidus (L-S) of the state diagram [1-6].

The purpose of the work is to clarify the mechanism of phase formation in the process of SHS, to find the relationship of the phase composition of the combustion product with the type of intermediate unstable nitrides formed in the combustion wave, and the diagram of the state of the system, with a change in various initial parameters.

The SHS of the samples was carried out in a constant pressure reactor in a nitrogen medium. The relative density varied from 0.22 to 0.38. The initial composition changed in the ratio: Co/Ti, wt. %. within the values of 5/50. The final and intermediate products were studied using RFA analysis and quenching. Changes in the concentration of the environment and the rate of combustion of samples were obtained by changing the initial parameters (initial concentration of substances, initial density of samples, diameter, height of samples, etc.).

Regardless of the initial composition, dispersion and density of the sample, the values of combustion parameters (combustion conversion, maximum burning temperature, amount of stoichiometric absorbed nitrogen) obtained in the experiment lie in the region between the S-L lines, i.e. in the region of solid-liquid suspension. SHS processes occur only in the solid-liquid melt L-S [7].

It is found that during the transition from "soludus" to "liquidus", the melting particles necessarily pass through the nanoscale. During the heating process, Co diffusely enters Ti and, Co into Ti. The incoming nitrogen interacts with these intermetallides by a catalytic mechanism. Titanium nitride is formed due to interaction with atomic N formed during the decay of Co nitride. As a result of the reaction, the final product consists of titanium nitride and an intermetallic matrix with a small amount of hardened cobalt nitrides. It is established that the amount of assimilated nitrogen forms integer atomic ratios with both Co and Ti. Thus, in the combustion wave, an intermediate, rapidly decaying nitride with a certain crystal lattice is formed, which can correspond only to the equilibrium nitride, according to the phase diagram. An invariant combining the experimental points is found, which is the atomic ratio of nitrogen and titanium in nitrides.

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