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SYNTHESIS OF SINGLE-PHASE NIOBIUM SILICID $NBSI_2$ AND NB_5SI_3

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Currently, silicides are widely used in various fields of science and technology for the implementation of special technological processes and the creation of materials with the necessary properties. Materials based on niobium silicides have been actively considered in recent years as a replacement for heat-resistant alloys in high-temperature structures, due to the highest melting temperatures and lower density than those of nickel-based heat-resistant alloys in aviation technology. Silicides were chosen as the main material for the blades of high-pressure turbines. There are attempts to use niobium–silicon-based composites for the production of additives for additive technologies. The niobium–silicon system is considered a low-energy system and it is considered impossible to carry out self-propagating high-temperature synthesis without any preliminary preparation in the form of separate heating or mechanical activation.

In this work, from powder mixtures Nb+37.7 wt. %Si ($NbSi_2$) and Nb+15.36 wt. % Si (Nb_5Si_3) cylindrical samples with a diameter of 12 mm, a weight of 5 g and a height of 14.5 and 11 mm, respectively, were formed by unilateral pressing. The initial reagents were powders Nb (particle size less than 40 microns) and Si (particle size less than 20 microns) with a frequency of at least 99.9%. Hollow cylinders with a diameter of 30 mm, a mass of 20 g and a height of 15 mm were formed from the powder mixture Ti+0.6 Si. Cylindrical holes with a diameter of 12.2 mm were formed along the axis of the samples, into which samples from a mixture of Nb and Si were placed. Control of the gorenje temperature Nb c Si used tungsten-rhenium thermocouples with a junction diameter of 100 microns. Thermocouples were placed to a depth of 3 mm from the lower end of the samples. The synthesis was carried out in an argon medium at a pressure of 1 atm. The initiation of gorenje samples from a mixture of Ti+ 0.6Si was carried out by a heated tungsten spiral from the upper end.

As a result of the experiments carried out, it was possible to carry out self-propagating high-temperature synthesis and obtain synthesized niobium silicides. The reaction products were easily daubed samples, the composition of which, according to X-ray phase and X-ray structural analysis, corresponds to single-phase products $NbSi_2$ and Nb_5Si_3 of hexagonal structure. The analysis of the structure by X-ray phase and microanalysis of the obtained products showed the formation of single-phase products $NbSi_2$ and Nb_5Si^3 hexagonal structure.