SYNTHESIS OF TIB_2-FE COMPOSITE POWDER TO PRODUCE A WEAR-RESISTANT ALLOY

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The high physical and mechanical characteristics of titanium diboride determine the possibility of using it as a structural and instrumental material. However, the use of products made of individual titanium diboride in technology is hampered by technological difficulties [1].

In this work, a method has been developed for producing TiB_2-Fe composite powder with high performance characteristics. Optimal modes for carrying out self-propagating high-temperature synthesis, grinding synthesis products and subsequent sintering have been found. The temperature characteristics of the synthesis and microstructure of the products were studied. Mechanical tests of the resulting materials were carried out and the possibility of using them in the timber processing industry was shown.

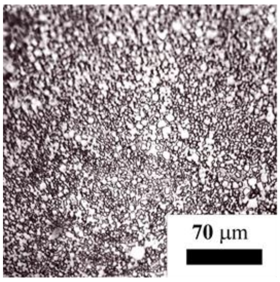
At the beginning, the TiB_2-Fe composite material was obtained by self-propagating high-temperature synthesis (SHS) in two ways: 1 - synthesis from ferroboron alloys (FeBn) and titanium; 2 - synthesis from the elements: titanium, boron and iron. Next, the material was grinded to the required fineness and optimal sintering conditions were selected [2].

In the work, for the preparation of reaction mixtures we used: titanium powders (PTS, less than 280 μm, PTM, less than 100 μm), amorphous boron (MRTU6-02-292-64, dispersion 0.1–10 μm), carbonyl iron (10 μm), ferroboron FB20 (boron content 20 wt.%).

As a result of the research, the fundamentals of the technology for producing hard alloys using powder metallurgy methods based on SHS-composite TiB_2-Fe powder with high performance characteristics (HRA 88-90, σ bend = 1200 MPa, wear resistance - at the level of VK 15) were developed.

Analysis of the microstructures (Fig.1, a) of the sintered samples indicates that boride crystallites in the sintered particles recrystallized through the molten matrix. Dissolution-precipitation of contacts between borides, sharp corners of TiB2 crystals, and dissolution of small particles occurred. As a result, after sintering, the titanium diboride crystals became rounded and became isolated from each other. The former pores were filled with molten eutectic with recrystallized TiB2 particles released from it.

The composite material we obtained from this SHS powder was used to strengthen the teeth of a circular saw (Fig. 1, b). 56 pieces of saw teeth were soldered and tested.



a


b

Figure 1 – Микроструктура спеченного композита, полученного из измельченного СВС материала (FeB2 + Ti) (A) и вид зубца дисковой пилы с напайкой из TiB2-Fe (b)

The chipboard plant of the Russian Ministry of Forestry Industry conducted special tests of circular saws with a diameter of 360 mm with tungsten-free hard alloy tips from the SHS composite TiB2-Fe.

The operating time of saws with VK-15 steel brazing tips without regrinding is 12 hours.

The use of the resulting hard alloy based on SHS-composite TiB2-Fe powder as brazing on a circular saw showed an increase in wear resistance by 1.2 times compared to the used hard tungsten alloy VK-15.

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