A STUDY OF PHASE FORMATION PROCESSES DURING OXIDATION OF AMORPHOUS BORON AND MODIFIED BY HYDROGEL OF VANADIUM PENTOXIDE

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For the first time, results have been obtained from a study of phase formation processes during oxidation of pure amorphous and V_2O_5-modified boron powders directly during programmed heating in air.

The oxidation features of the initial and gel-modified vanadium pentoxide boron powders were studied by X-ray phase analysis using a synchrotron radiation source at a heating rate of 10 °C/min in air. The main difference in the diffraction patterns of the initial and modified B upon heating after 300 °C is the difference in temperatures at which the reflexes corresponding to β-B practically disappear. For the initial boron, this temperature is 642 °C, and for the one modified with vanadium pentoxide, it is 435 °C. Above these temperatures, only boron nitride is clearly observed in the diffraction patterns, which, according to X-ray phase analysis, is contained in the B powder at about 1%.

In the low-temperature region, the modification of boron with V_2O_5 leads to changes associated with the presence of boric acid in the initial and modified boron. In the initial boron in the crystalline state, $B(OH)_3$ is not recorded in the diffraction patterns. After modification, the lines of the crystalline phase of boric acid are recorded, and when heated to 106 °C, the transition form $B_3H_3O_6$ is observed. The reasons for these changes are the processes occurring when V_2O_5 is applied to the surface of the initial boron powder.

Based on the results of the study, it was concluded that the mechanism of activation of boron oxidation by vanadium pentoxide is based on oxidation-reduction reactions involving vanadium, which is capable of changing the oxidation state in a wide range and increasing oxygen transport in the melt.

Comparison of the results of phase analysis of the initial and modified powder B with the results of TG and DSC studies obtained under similar heating conditions in an air environment allows us to conclude that the mechanism of boron oxidation activation is based on oxidation-reduction reactions involving vanadium pentoxide, the ability of vanadium to change the oxidation state and increase oxygen transport in the V_2O_5 melt.

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