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SELF-PROPAGATING HIGH-TEMPERATURE SYNTHESIS OF BORIDE CONTAINING COMPOSITES

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Self-propagating high-temperature synthesis (SHS) has been used to prepare many refractory materials such as carbides, borides, silicides, oxides, hydrides, intermetallics and complex composites [1, 2] Transition metal borides are of special interest due to their unique physical-chemical properties and are widely used as the most promising materials in many branches of engineering, machine building, electronics, power industry [3]. However, strong covalent bonds inherent to phases of pure diborides of transition metals lead to low plasticity and low strength, thereby limiting the field of their use to a great extent. In this connection, at present great attention is paid to the technology of production of multicomponent composition materials containing metal borides in combination with more plastic materials playing the role of a binder. These can be, for example, aluminum or magnesium oxides which play the role of a high temperature binder and filler decreasing the content of expensive diboride, when producing composition materials [3, 4].

The aim of this study is SHS composite materials based on borides of titanium, chromium, zirconium using borate ore of Inder deposite of the Republic of Kazakhstan. SH-synthesis was carried out in the systems TiO_2–B_2O_3–Al, Cr_2O_3–B_2O_3–A1, $ZrSiO_4$–Al–B_2O_3, (where B_2O_3 is in the composition of borate ore). Samples were prepared from the charge containing titanium, chromium oxides, aluminum, borate ore of Inder deposit (the content of boron oxide up to 40 %), natural mineral-zirconium $ZrSiO_4$. Preliminary mechanical activation was carried out in a high power planetary-centrifugal mill. The microstructure and phases composition of synthesized products were investigated uing microanalyses-scanning electron microscope JCXA–733 (JEOL) "Superprobe" and Hitachi S–4800 FE–SEM, Japan and XRD. The prepared samples were burnt at room temperature in air initiating ignition by magnesium.

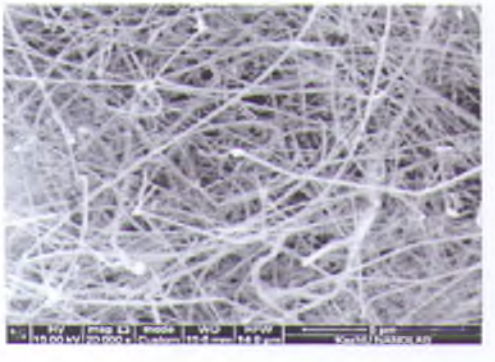

Figure 1. The microstructure of SHS products of the system $ZrSiO_4$–Al–B_2O_3.

Investigation of the microstructure of the compositions revealed the formation of whiskers of aluminum oxide with length of about 10 – 25 μm and with diameter of 50 – 200 nm (Figure 1). The possibility of using borate ore of Inder deposite for synthesis of refractory composite is shown.

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