FORMATION OF THE PHASE COMPOSITION AND STRUCTURE OF ALUMOMAGNESIUM SPINEL OBTAINED BY THE SHS METHOD

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Alumomagnesium spinels were obtained using the method of self-propagating high-temperature synthesis (SHS).

The powders of aluminium oxides (Al_2O_3, «pure»), magnesium (MgO, «pure») and magnesium nitrate ($Mg(NO_3)_2 \cdot 6H_2O$, («chemically pure»)) containing aluminium (ASD-4) with amorphous boron additives were used as an initial mixture. The mixture of aluminium and boron allowed us to intensify the ignition and combustion of mixtures [1, 2]. Spinel was synthesized in metal mesh cups at atmospheric pressure in air. Ignition was initiated by an electric spiral. The development of chemical reactions was investigated using the thermogravimetric method and the Q600 thermal analyzer. The phase composition of reaction products was studied using X-ray diffraction analysis and the DRON-3M diffractometer. Structural peculiarities were studied using IR spectroscopy (Nicolet 5700 FT-IR spectrometer). The microstructure of the samples obtained was studied by optical microscopy (Axiovert 200M) and scanning electron microscopy (Philips SEM 515).

The results have shown that adding amorphous boron to the initial components contributes to the formation of low-melting B_2O_3 and aluminum (magnesium) borates during combustion. Aluminomagnesium spinel crystals grow in a short time during rapid SHS processes with the participation of liquid and gas phases, which leads top the formation of hollow skeletal crystals with a size from 1 μm to 10 μm.

Figure 1 shows the microstructure of aluminomagnesium spinel obtained using 2 wt.% of boron as an additive.

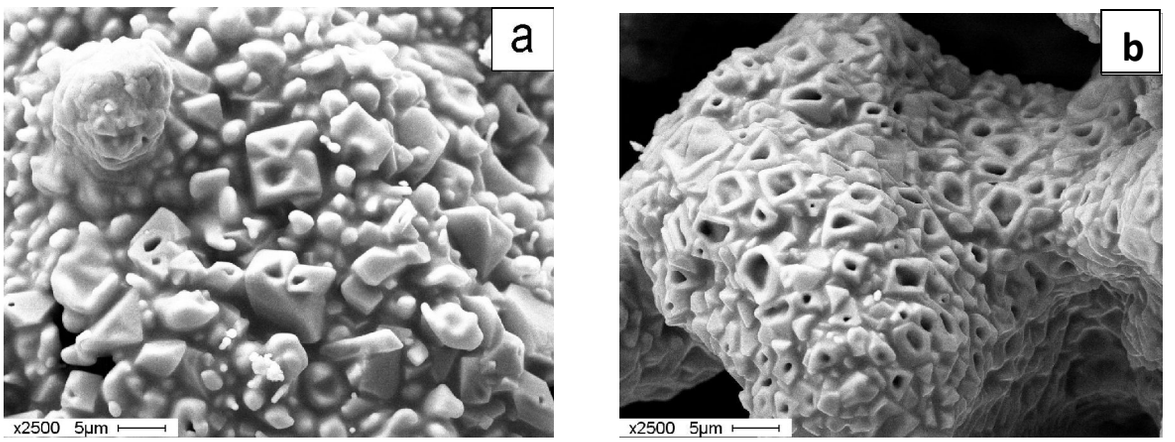

Fig.1. Micrograph of the products obtained by the SH- synthesis of alumomagnesium spinel (composition: M6 with 2 wt.% of boron), (a) - aggregates of large crystals, (b) - aggregates of smaller crystals, Philips SEM 515.

The products consist mainly of the $MgAl_2O_4$ phase and corundum Al_2O_3 in small amount. The IR-spectroscopic method demonstrates the presence of B_2O_3, aluminum borate, and α-BN.

Alumomagnesium spinel, chemically resistant to aggressive media, has high refractory properties and can be used as structural ceramics.

REFERENCES

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