INFLUENCE OF CHROMIUM CARBIDE ADDITION ON THE SHRINKAGE KINETICS OF [ZrB_2-SiC] CERAMIC SYSTEM

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Development of advanced ultra-hightemperature materials based on zirconium borides associated with a number of difficulties, especially with the requirement of high temperatures during sintering. In this paper we investigated the activating influence of Cr_3C_2 on the shrinkage kinetics [ZrB_2-SiC] system and optimized technological parameters of hot pressing, as to provide the required service properties of ceramics.

During hot pressing ZrB_2 without additives the relative density ρ=0,946 obtained at T=2215°C. With adding of 20 vol.% SiC to a zirconium boride the compact material is obtained at 2075°C, and at using as an activatin addition of 5 wt.% Cr_3C_2 the hot pressing temperature of ZrB_2 is reduced to 1520°C (Fig.1).

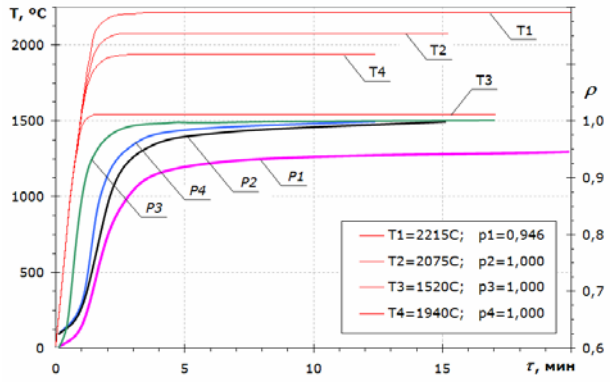

Fig. 1 Effect of chromium and silicon carbides on shrinkage kinetics of zirconium boride.
P1) ZrB_2, T=2215°C
P2) [80 vol.% ZrB_2 + 20 vol.% SiC]
P3) [ZrB_2 + 5 wt.% Cr_3C_2]
P4) [(80 vol.% ZrB_2 + 20 vol.% SiC) + 5 wt.% Cr_3C_2]

However, at simultaneous using of these two additives in the same amounts the composition becomes compact only at T=1940°C. Reduced activating properties of Cr_3C_2 in the latter case presumably due to the phase transformations in the ternary system that will be studied in the future.

As can be seen from the figure, in the composition [80 vol.% ZrB_2 + 20 vol.% SiC] at sintering temperatures 2075°C there is a degree of porosity of about 5% (Figure 2).

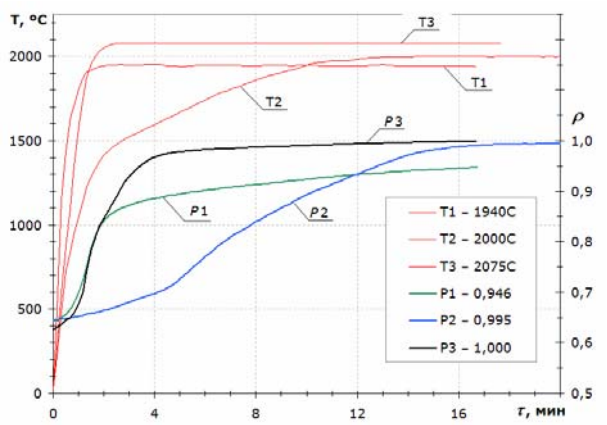

Fig. 2 Shrinkage kinetics composition [80 vol.% ZrB_2 + 20 vol.% SiC]

At the same time, by adding 5 wt.% of Cr_3C_2 to [ZrB_2 + 20 vol.% SiC] composition the pore-free state is achieved during hot pressing at a temperature 1940°C (Fig. 3) and sintering time is reduced.

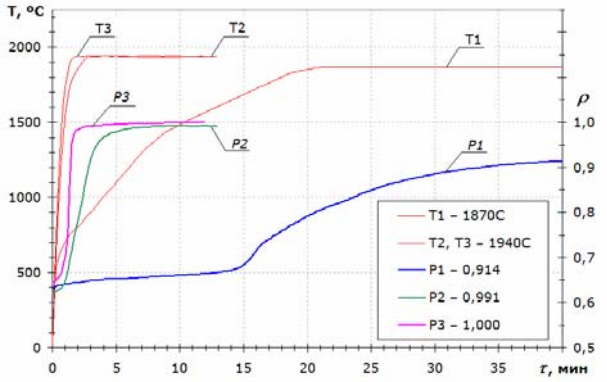

Fig. 3 Shrinkage kinetics composition [(80 vol.% ZrB_2 + 20 vol.% SiC) + 5 wt.% Cr_3C_2]

It is also shown that reducing of temperature rise speed (curves T2, T3) leads to slower rate of compaction (curves P2 and P3). Reducing the heating rate to 60…100 °C/min (curve T1) significantly slows shrinkage and when the sintering time increases up to 40 minutes, a porosity is 8.6%.

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