CONTACT INTERACTION IN ZrB_2 - SiC - Cr_3C_2 CERAMIC SYSTEM

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Ultra-hightemperature ceramics on ZrB_2 and HfB_2 base is a promising material for the heat and nuclear energetics, aerospace and other branches of engineering. Previously (1, 2) it was investigated the contact interaction in [ZrB_2-Cr_3C_2] system at temperatures of 1350-1600°C, were studied phase transformations and the kinetics of compaction, was fixed the eutectic nature of structure formation. It was established the formation of the diffusion zone with thickness of 5-10 microns, consisting of layers of discontinuous grained crystallites of new phases - solid solutions based on zirconium carbide and chromium borides, resulting from the exchange of boron and carbon by the initial phases. These phase interactions are responsible for the activation of syntering process and diminution of sintering temperature of pore-free state obtainment for about 600°C relative to the sintering temperature of the single-phase boride of zirconium. However, in the three-phase system [ZrB_2-SiC-Cr_3C_2] found a decrease of sinterability. Investigation of interaction of the components in three-phase system during hot pressing is fulfilled in the present work.

Typical structure of the diffusion zone between the Cr_3C_2 (the left side of the figure) and [ZrB_2-SiC] (right side) are shown in Fig. 1.

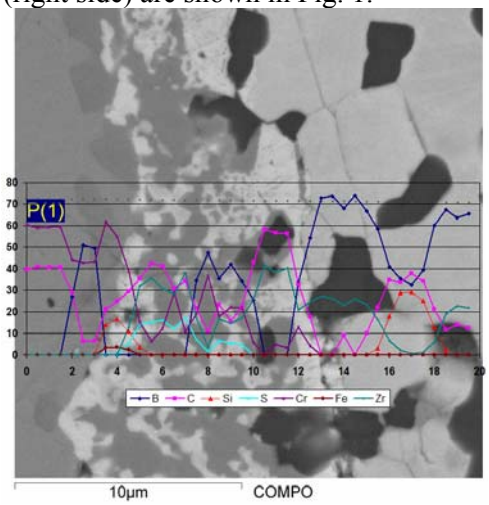

Fig.1 Structure of the diffusion zone. Contact interaction [80ob.% ZrB_2 +20ob.% SiC] and Cr_3C_2 at 1380°C and holding for 15 minutes

According MRSA, as in the case of the diffusion zone in the binary system [ZrB_2-Cr_3C], through the boundary of the primary contacts in the ternary system occurs diffusion of chromium and carbon on the one hand, and boron in the opposite direction to form the above mentioned solid solutions on the carbide of zirconium base (white grains in the diffusion zone) and chromium carbon-borides (dark grains). This transformation takes place through the eutectic liquid phases formed at the initial stages of interaction. However, the essential difference between the processes in the two-and three-phase systems is that the grains of silicon carbide dissolve in the liquid phase within the diffusion zone is the source of silicon. Silicon diffuses toward chromium carbide and forms a substantially continuous layer of chromium carbon- silicide (3) and immediately adjacent to the interface of chromium carbide.

Analysis of the results leads to the assumption that slowing the rate of sintering in the ternary system [ZrB_2-SiC-Cr_3C_2] compared to double [ZrB_2-Cr_3C_2] is due to the formation of this additional layer of relatively refractory chromium carbon- silicide, which restricts mutual diffusion of components through the contact boundary grains.

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1. Vinokurov V.B., et. al., Study the kinetics of compaction of ZrB2-Cr3C2 - based materials at hot pressing / / 3rd International Samsonov's Conference "Material scince of refractory compounds" (May 2012, Kiev). - Kiev: IPM.
2. Grigoriev O.N., et. al., Contact interaction in the ZrB2-Cr3C2 system. / / HighMatTech. Proceedings of International Conference (October 2013, Kiev). - Kiev: IPM.
P. W. Pellegrini, B. C. Giessen, and J. M. Feldman, Isothermal section of Cr-Si-C system at 1400°C, J. Electrochem. Soc., 119 [4] 535-537 (1972).