SPECIFIC ENERGY AT SINTERING OF CERAMICS ON THE BASIS OF BORON CARBIDE IN VARIOUS TECHNOLOGICAL PROCESSES

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Process of sintering of ceramics on the basis of boron carbide is known as one of the most difficult among other techno-logical processes of sintering of refractory materials. It is known, that the basic methods of sintering B_4C are hot pressing [1-4], sintering at a high pressure (to 7,7 GPa) [5] and reactionary sintering [6-8]. However, for realisation of these ways, despite high enough values physico-mechanical properties of sintered materials, are necessary rather high temperatures(>2000^{0}C) and big duration of sintering process that leads to partial oxidation of boron carbide, and also disintegration of used activators.

The increase in external pressure at sintering gives the chance to reduce duration of process of sintering, to lower temperature of sintering and to make active sintering process. Application of activating additives at hardfase sintering, at the expense of their dissolution in the basic phase with formation cationic or anionic vacancies, increases factor of self-diffusion of a material that allows to lower sintering temperature also. Now a wide number of activators is known at sintering of boron carbide. As activators of process of sintering of ceramics of this type most often use TiO_2, ZrO_2, B_2O_3, TiB_2, ZrB_2, CrB_2, TiH_2, B_4Si, Al, Fe, Cr_3C_2, SiC, AlN and other.

Last time special attention of researchers is given electric discharge sintering. The founder of resistive electricsintering of powder materials Rajchenko A.I. deve-loped in 1987 a method of electric dis-charge sintering is. Now in the field of electric discharge sintering a number of perspective ways, including, a method of sintering SPS (the method is developed by Sumitomo Coal Mining Co., Ltd.) and its analogue FAST (developed by FCT Syste-me GmbH) or PAS (Plasma Assisted Sin-tering) and also electric discharge a way - EDS (Electric Discharge Sintering). Method for sintering of boron carbide a number of researches [9-12] is devoted application of these.

It is possible to carry to this number of ways of electricsintering also developed in of V.Bakul ISM NAS Ukraine a way of intensive electricsintering under pressure (IESP) [13]. The essence of this way consists in heating of preliminary pressed briquettes powder by Joule's heat at the expense to pass an direct electric current of industrial frequency in steel technolo-gical container of modified the high-pressure apparatus of "cylinder-piston" type in the nonelectroconductive container with simultaneous pressing by pressure (to 0,5GPa).

However, at sintering of nonelectro-conductive compositions, in particular, on the basis of the boron carbide, the described way IESP essentially does not differ from above mentioned as briquette heating occurs at the expense of heating of the graphite press-form, that very limits level of pressure.

Research of influence is carried out the present work of some activators TiO_2, ZrO_2, CrB_2, ZrB_2, B_4Si, AlN on density and specific of energy at sintering of ceramics on the basis of boron carbide. The example of change of parametres of an electric current(J,U), temperature of a briquette (t) and it shrinkage (h) in the process of sintering is resulted on fig.1.

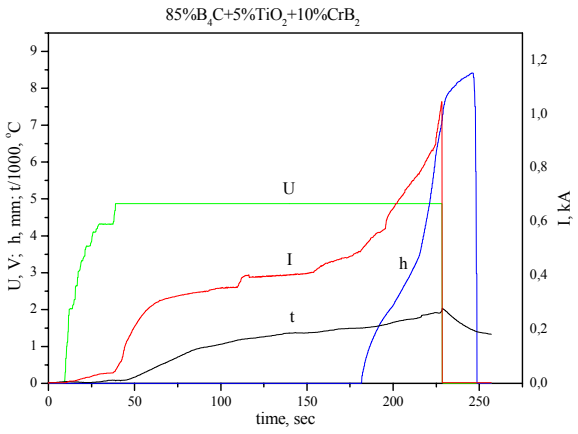

Fig. 1 Characteristic change of para-metres of process intensive electric-sintering of boron carbide under pressure with system TiO_2+CrB_2 activator