DIRECT CURRENT ARC-PLASMA SYNTHESIS OF B-C POWDER PRODUCT*

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Boron carbide is widely spread, super-hard material, which is characterized by low density (~2.5 g/cm^3) high melting temperature (~2620–2740 °C), high resistivity to some radiation and other unique properties [1]. Boron carbide can be synthesized by several methods, such as: carbo-thermal reduction of boron oxide, plasma spraying, melt crystallization, and CVD [2-5]. Last years a new method of direct current arc discharge has been developed for carbon nanostructures [6] and boron carbide [7] synthesis. The main feature of this method is the possibility to operate at generating the ambient air plasma. This procedure is becoming possible due to carbon monoxide generation during arcing, that results in gas, which can insulate the reaction zone and prevent oxidation from synthesis products. The procedure implementation has been discussed before in [6-7]. In this paper we study the crystalline phase composition and crystallinity of powder products in link with a synthesis process time. The arc discharge experiments were conducted by DC APAS-method (direct current arc plasma air synthesis) at a plasma chemical reactor that is introduced in [7].

According to X-ray diffraction data (Shimadzu XRD 7000s, λ=1.54060 Å, CuKα) a typical product consists of three main crystalline phases: graphite (C (graphite)), boron oxide B_2O_3, as initial raw materials, and synthesized boron carbide $B_{13}C_2$. The phase composition depends on arc discharge tome as mentioned below in Fig. 1.

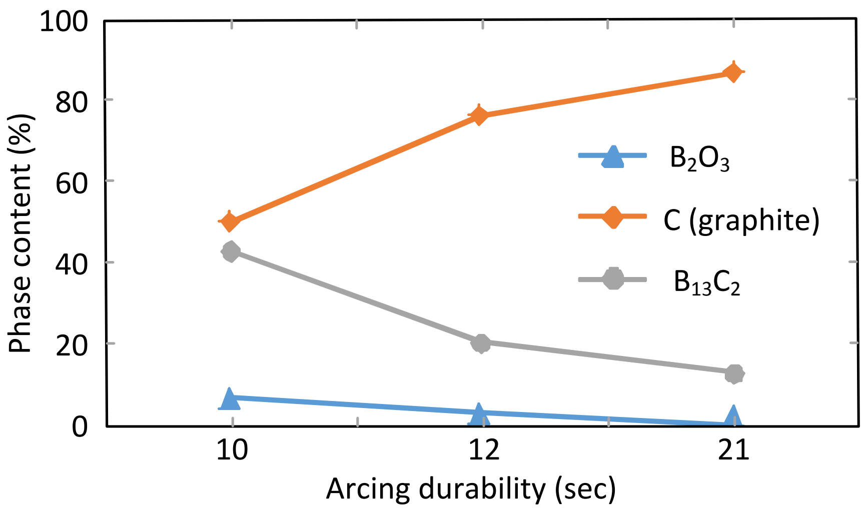

Fig. 1. Phase composition and arcing time dependence

The maximum time is 21 seconds that can lead to full mass of initial boron oxide consumption. At this time the content of graphite increases owing to the anode erosion effect [8]. According to these data we make a conclusion that arcing time influences the phase composition through energy input variation by time control. Besides, it is possible to obtain two phase composition of a product by full mass of the boron oxide consumption.

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