Synthesis of boron carbide powder from cellulose and boric acid using freezing-thawing technique

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Abstract: Boron carbide is well known for its high hardness and low density. However, synthesis of high purity boron carbide powder is complicated. Studies on boron carbide powder synthesis have been widely reported in order to reduce process temperature and obtain fine microstructure. In this study, low temperature synthesis of boron carbide powder from the highly homogeneous precursor improved by freezing-thawing technique was attempted. Precursors prepared from boric acid (BA) and cellulose microcrystalline powder (CL) were heated under inert gas atmosphere to promote the reaction to form boron carbide. BA:CL mole ratios were varied from 4:1 to 6:1. Phase, morphology and chemical structure of the synthesized powder were identified by X-ray diffraction (XRD), scanning electron microscope (SEM) and Raman spectroscopy, respectively. It was shown that degree of crystallization of boron carbide increased with the synthesis temperature. Mole ratio between BA and CL had an effect on the purity of synthesized powder where the composition with boron excess was preferred.

Keywords: Boron carbide; Freezing-Thawing technique; Powder synthesis