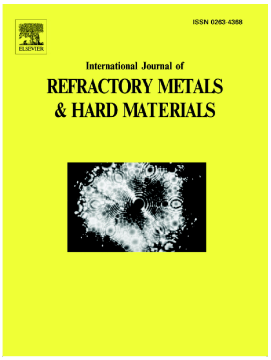

Boron carbide B4C ceramics with enhanced physico-mechanical properties sintered from multimodal powder of plasma dynamic synthesis

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Boron carbide B_4C ceramics with enhanced physico-mechanical properties sintered from multimodal powder of plasma dynamic synthesis

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Abstract

Boron carbide B_4C as one of the hardest materials known is of a great scientific interest for years due to a unique combination of different useful properties. The ceramics on its basis has many prospective applications. However, the widespread usage of this ceramics is limited due to the relatively low fracture toughness as well as the poor sinterability. This work shows the possibility to obtain the ceramics with enhanced physico-mechanical properties based on the powdered boron carbide B_4C prepared by a plasma dynamic method. The key features of this powdered material are a single-crystalline particle structure and their multimodal distribution from several nanometers to several micrometers that is confirmed by the results of both scanning and transmission electron microscopy. Sintering the ceramics based on the as-prepared B_4C powder by SPS technology at the temperature of 1950°C, pressure of 60 MPa and time exposure of 5 min allows not only achieving the expected values of ceramics density (~99% relative to the theoretical one) but also the high hardness (~37 GPa) and fracture toughness (6.7 ± 0.3 MPa·m$^{1/2}$).

Keywords:

Boron carbide B_4C; plasma dynamic synthesis; multimodal powder; ceramics; physico-mechanical properties