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Determining the fracture resistance of B_4C-NanoSiB_6 nanocomposite by Vickers indentation method and exploring its mechanical properties

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Abstract

In this research, the effects of NanoSilicon hexaboride (NanoSiB_6) additive, as a sintering aid, on mechanical properties and the sinterability of Boron Carbide (B_4C) have been investigated. In addition, the results of several equations used for determining the Indentation fracture resistance (K_{IFR}) by Vickers indentation test have been evaluated. For this purpose, 0, 2, 4, 6 and 8 wt. % NanoSiB_6 additive have been added to B_4C in order to improve its sinterability at temperatures 2050, 2150 and 2250 ºC. The findings indicate that by adding NanoSiB_6, up to 4 wt. %, to B_4C, its properties such as relative density, Young's modulus, microhardness and K_{IFR} improve as the sintering temperature rises; however, these properties diminish with the further increase of the mentioned sintering aid. Also, a comparison between K_{IFR} values shows the closeness of the results obtained by different equations and the satisfactory accuracy of the equation for determining K_{IFR} by crack area method compared to the results of other equations; with a difference of less than 20% between the two results.