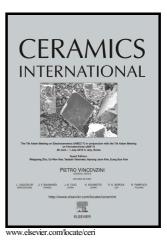
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Processing, Microstructure, and Mechanical Properties of Zirconium Diboride-Boron Carbide

Ceramics

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Abstract

The processing, microstructure, and mechanical properties of zirconium diboride-boron carbide (ZrB_2-B_4C) ceramics were characterized. Ceramics containing nominally 5, 10, 20, 30, and 40 vol% B₄C were hot-pressed to full density at 1900°C. The ZrB_2 grain size decreased from 4 to 2 µm and B₄C inclusion size increased from 3 to 5 µm for B₄C additions of 5 and 40 vol% B₄C, respectively. Elastic modulus decreased from 525 to 515 GPa and Vickers hardness increased from 15 to 21 GPa as the B₄C content increased from 5 to 40 vol%, respectively, following trends predicted using linear rules of mixtures. Flexure strength and fracture toughness both increased with increasing B₄C content. Fracture strength was 450 MPa with a 5 vol% B₄C addition, increasing to 590 MPa for a 40 vol% addition. The critical flaw size was calculated to be ~30 µm for all compositions, and analysis of the fracture surfaces indicated that strength was controlled by edge flaws generated by machining induced sub-surface damage. Increasing amounts of B₄C added to ZrB₂ led to increasing hardness due to the higher hardness

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