MECHANICAL PROPERTIES OF BOROTHERMALLY SYNTHESIZED ZRB_2

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Mechanical properties of borothermally synthesized, highly pure ZrB_2 were tested at room and elevated temperatures. Commercially available ZrB_2 powder typically contains 1 to 4 wt % hafnium which has been shown to lower thermal properties of dense ZrB_2 ceramics. Further, commercial grade ZrB_2 contains other impurities (0.6 wt% O, 0.11 wt% N, 0.04 wt% Fe and others) which are also known to decrease its high-temperature mechanical strength. Purer grades of zirconia and boron powders, containing < 75 ppm hafnium and <0.5 wt% of other metal impurities, were reacted to produce ZrB_2 for room and elevated temperature mechanical property studies.

The zirconia and boron powders were reacted at 1000°C in a graphite vacuum furnace for two hours. The synthesized ZrB_2 powder was then rinsed with methanol to remove boria from its surfaces, sieved with a #45 mesh, and hot pressed to near full density with 32 MPa applied pressure in a flowing argon atmosphere at 2100°C. The hot pressed billets were machined to ASTM standard test bars with the flexure surface polished to 1 um. Young's modulus, Vickers Hardness, fracture toughness, and four-point bend strength were measured, and the results will be discussed.