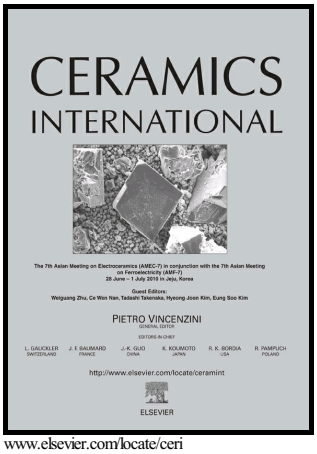

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A High Strength Alumina-Silicon Carbide-Boron Carbide Triplex Ceramic

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Abstract

A ceramic particulate composite composed of oxide, and carbide ceramics was found to have high strength, hardness, and fracture toughness values. A composition consisting of Al_2O_3 with 15 vol% SiC and 15 vol% B_4C additions was produced by hot-pressing at 1650°C for 30 min, with full density reached after ~5 min at temperature. Both WB and WB_2 were observed, with the W source presumably ~~being~~ an impurity from WC milling media, and $Al_{18}B_4O_{33}$ was also detected following densification. Strength was ~880 MPa, which is greater than values reported for comparable composites of Al_2O_3 containing 30 vol% SiC or B_4C. Vickers hardness was ~21 GPa, and fracture toughness was ~4.5 MPa·$m^{½}$, comparable to values reported for the binary mixtures. The ~~strength limiting~~calculated critical flaw size of the material was ~~either~~ similar to the size of the SiC/B_4C clusters ~~or~~and microcracking at grain boundaries. The latter ~~resulted~~resulting from thermal expansion mismatch between the Al_2O_3 matrix and SiC/B_4C reinforcing phases.

Keywords: aluminum oxide, silicon carbide, boron carbide, strength, microstructure, hot-pressing

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