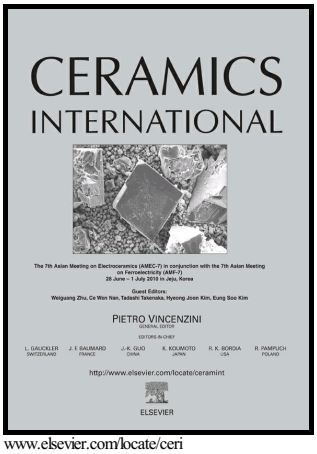

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Gel-cast hierarchical porous B_4C/C preform and its role in fabricating reaction bonded boron carbide composites

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Abstract

The resorcinol-formaldehyde (RF) gel-casting system is employed for the first time to fabricate a hierarchical porous B_4C/C preform, which was subsequently used for the fabrication of reaction bonded boron carbide (RBBC) composites via a liquid silicon infiltration process. The effect of the carbon content and carbon structures of this perform on the microstructures and mechanical properties of B_4C/C preform and the resultant RBBC composites is reported. The B_4C/C preform (16 wt.% carbon) exhibit a strength of 34 ± 1 MPa. The obtained RBBC composites shown uniform microstructure is consisted of SiC particles bonded boron carbide scaffold and an interpenetrating residual silicon phase. The Vickers hardness, flexural strength and fracture toughness of the RBBC composites (16 wt.% carbon) are 24 GPa, 452 MPa and 4.32 $MPa \cdot m^{1/2}$, respectively.

Keyword: Gel-casting; Liquid silicon infiltration; Boron carbide; Mechanical properties

1. Introduction

The superior wearing resistance and other mechanical properties of boron carbide (B_4C) render this material a leading candidate for a wide variety of applications including blasting nozzles, ceramic bearings and wire drawing dies [1, 2]. Low density and high hardness also make the B_4C extremely useful for fabrication of the

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