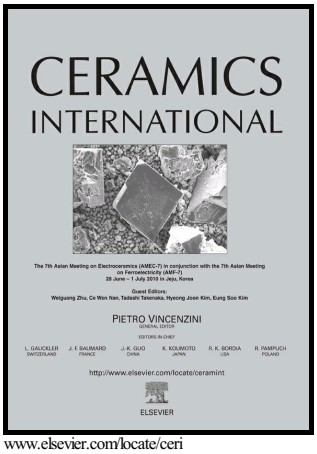

www.elsevier.com/locate/ceri

Stabilization of Highly-Loaded Boron Carbide Aqueous Suspensions

Andres Diaz-Cano, Rodney W. Trice, Jeffrey P. Youngblood

PII: S0272-8842(17)30481-9
DOI: http://dx.doi.org/10.1016/j.ceramint.2017.03.111
Reference: CERI14880

To appear in: *Ceramics International*

Received date: 31 January 2017
Revised date: 20 February 2017
Accepted date: 15 March 2017

Cite this article as: Andres Diaz-Cano, Rodney W. Trice and Jeffrey P. Youngblood, Stabilization of Highly-Loaded Boron Carbide Aqueous Suspensions, *Ceramics International*, http://dx.doi.org/10.1016/j.ceramint.2017.03.111

Stabilization of Highly-Loaded Boron Carbide Aqueous Suspensions

Andres Diaz-Cano, Rodney W. Trice, Jeffrey P. Youngblood.

School of Materials Engineering, Purdue University, West Lafayette, Indiana 47907, USA

Abstract:

Injection molding of boron carbide (B_4C) slurries affords the production of complex-shaped personal armor. To injection mold, however, requires preparation of a well dispersed, flowable suspension with >45 vol.% B_4C loadings to reduce porosity that must be removed during sintering. In the present study, the preparation of highly-loaded B_4C suspensions is investigated using zeta potential and rheological measurements, varying dispersant type, molecular weight, and amount. Of those dispersants investigated, polyethylenimine (PEI) with a molecular weight of 25,000 g/mol was found to produce suspensions with up to 56 vol.% B_4C and the requisite rheological properties suitable for injection molding. A PEI concentration of 1.83 mg/m^2 was established as the appropriate to produce highly-loaded B_4C suspensions. The effect of a prior B_4C powder treatment (ethanol washed or attrition milled) on rheological properties of the suspensions was also investigated. The PEI was completely burned out in argon, nitrogen, and air at 450 °C.

Key words: Boron carbide, suspensions, rheology, polyethylenimine PEI, zeta potential.

1.0 Introduction

Boron carbide (B_4C) is the third hardest material after diamond and cubic boron nitride. Depending on how it is processed, hardness values approaching 35 MPa can be achieved [1,2]. B_4C is frequently used in high wear applications, e.g. sand blasting nozzles; it is also desirable as an abrasive and for cutting tools. Its neutron absorption capacity makes B_4C a common material for shields and control rods in nuclear reactors [3]. Due to its low density of 2.52 g/cm^3, B_4C is