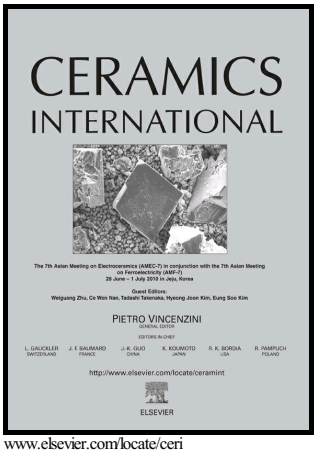
HfB_2-CNTs composites with enhanced mechanical properties prepared by spark plasma sintering

Hua Jin, Songhe Meng, Weihua Xie, Chenghai Xu, Jiahong Niu



www.elsevier.com/locate/ceri

PII: S0272-8842(16)31990-3
DOI: http://dx.doi.org/10.1016/j.ceramint.2016.10.200
Reference: CERI14079

To appear in: *Ceramics International*

Received date: 10 October 2016
Revised date: 29 October 2016
Accepted date: 30 October 2016

Cite this article as: Hua Jin, Songhe Meng, Weihua Xie, Chenghai Xu and Jiahong Niu, HfB_2-CNTs composites with enhanced mechanical properties prepared by spark plasma sintering, *Ceramics International*, http://dx.doi.org/10.1016/j.ceramint.2016.10.200

HfB_2-CNTs composites with enhanced mechanical properties prepared by spark plasma sintering

Hua Jin, Songhe Meng, Weihua Xie*, Chenghai Xu, Jiahong Niu

National Key laboratory of Science and Technology on advanced composites in Special Environments, Harbin Institute of Technology, Harbin 150001, P.R. China

***Corresponding author:** Weihua Xie, **Tel/Fax:** +86-451-86412259. michael@hit.edu.cn

Abstract

HfB_2-*x* vol.%CNTs (*x*=0, 5, 10, and 15) composites are prepared by spark plasma sintering. The influence of CNTs content and sintering temperature on densification, microstructure and mechanical properties is studied. Compared with pure HfB_2 ceramic, the sinterability of HfB_2-CNTs composites is remarkably improved by the addition of CNTs. Appropriate addition of CNTs (10 vol.%) and sintering temperature (1800 °C) can achieve the highest mechanical properties: the hardness, flexural strength and fracture toughness are measured to be 21.8±0.5 GPa, 894±60 MPa, and 7.8±0.2 $MPa \cdot m^{1/2}$, respectively. This is contributed to the optimal combination of the relative density, grain size and the dispersion of CNTs. The crack deflection, CNTs debonding and pull-out are observed and supposed to exhaust more fracture energy during the fracture process.

Keywords: B. Composites; C. Mechanical properties; E. Structural applications

1 Introduction

Due to the unique properties of Hafnium diboride (HfB_2), such as high melting temperature (3380°C), good mechanical properties, excellent thermal performance and