Title: Hard and easy sinterable B_4C-TiB_2-based composites doped with WC

Authors: Simone Failla, Cesare Melandri, Luca Zoli, Guido Zucca, Diletta Sciti

PII: S0955-2219(18)30124-9
DOI: https://doi.org/10.1016/j.jeurceramsoc.2018.02.041
Reference: JECS 11756

To appear in: *Journal of the European Ceramic Society*

Received date: 23-10-2017
Revised date: 24-2-2018
Accepted date: 28-2-2018

Please cite this article as: Failla S, Melandri C, Zoli L, Zucca G, Sciti D, Hard and easy sinterable B_4C-TiB_2-based composites doped with WC, *Journal of The European Ceramic Society* (2010), https://doi.org/10.1016/j.jeurceramsoc.2018.02.041

Hard and easy sinterable B_4C-TiB_2-based composites doped with WC

Simone Failla[1], Cesare Melandri[1], Luca Zoli[1], Guido Zucca[2], Diletta Sciti[1]*
[1]*CNR-ISTEC, Institute of Science and Technology for Ceramics, Via Granarolo 64, I-48018 Faenza (Italy).*
[2] *Italian Air Force, Flight Test Center, Technology Material for Aeronautics and Space Depot, Pratica di Mare, Roma (Italy).*

**corresponding author, diletta.sciti@istec.cnr.it*

ABSTRACT

B_4C-TiB_2 composites were contaminated with WC to study the effect on densification, microstructure and properties. WC was introduced through a mild or a high energy milling with WC-6wt%Co spheres or directly as sintering aid to 50vol% B_4C/50vol%TiB_2 mixtures. High energy milling was very effective in improving the densification thanks to the synergistic action of WC impurities, acting as sintering aid, and size reduction of the starting TiB_2-B_4C powders. As a result, the sintering temperature necessary for full densification decreased to 1860 °C and both strength and hardness benefited from the microstructure refinement, 860±40 MPa and 28.5±1.4 GPa respectively. High energy milling was then adopted for producing 75vol% B_4C/25 vol% TiB_2 and 25 vol% B_4C/ 75vol%TiB_2 mixtures. The B_4C-rich composition showed the highest hardness, 32.2±1.8 GPa, whilst the TiB_2-rich composition showed the highest value of toughness, 5.1±0.1 MPa $m^{0.5}$.

Keywords:

High-energy milling; hardness; strength; solid solution; armour materials

1. Introduction

Despite the huge amount of literature, research on B_4C materials is still alive and kicking, with researchers still struggling with a list of issues and potential solutions [1]. Boron carbide is indeed one of the lightest and hardest ceramics, with a unique combination of physical and