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Hard and easy sinterable B₄C-TiB₂-based composites doped with WC

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ABSTRACT

B₄C-TiB₂ 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% B₄C/50vol% TiB₂ 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 TiB₂-B₄C 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% B₄C/25 vol% TiB₂ and 25 vol% B₄C/ 75vol% TiB₂ mixtures. The B₄C-rich composition showed the highest hardness, 32.2±1.8 GPa, whilst the TiB₂-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 B₄C 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

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