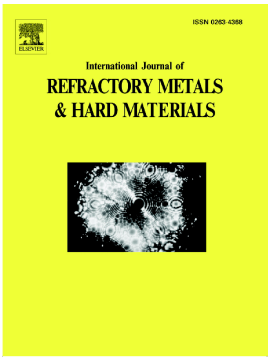

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Effect of Al_2O_3 ceramic binder on mechanical and microstructure properties of spark plasma sintered WC-Co cermets

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Abstract

This study investigates how the partial replacement of Co with Al_2O_3 ceramic binder has an effect on the sintering behaviour, microstructure, and final mechanical properties of WC-Co cermets via spark plasma sintering. To examine this, three batches (WC-6wt%Co, WC-3wt%Co-3wt%Al_2O_3, and WC-6wt%Al_2O_3) were mixed through high energy ball mill, and sintering was carried out at temperatures of 1350 ºC and 1600 ºC. The results showed nearly full dense WC-Co cermets at different temperatures. It was shown that WC-6wt%Al_2O_3, in comparison to reference WC-6wt%Co cermet, not only led to the rise in sintering temperature from 1350 ºC to 1600 ºC, but also reduced its strength and toughness. But replacing some part of Co with alumina (WC-3wt%Co-3wt%Al_2O_3) exhibited the combination of high strength (1095 MPa), hardness (17.62 GPa), and fracture toughness (19.46 MPa. $m^{1/2}$).

Keywords: Tungsten carbide, Alumina, Cobalt, SPS, Mechanical properties.

1. Introduction

WC-based cermets are used widely in cutting tools, dies, mining tools, and wear-resistant parts due to its properties which include high hardness, wear-resistance, chemical stability, and proper mechanical capabilities in high temperatures [1-5]. One of the most important binders used in WC-based cermets is Co. Although Co binder improves the sintering process and increases strength and toughness considerably, there are some problems too. These include the toxic nature

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