

FINE-GRAINED WC-VC-Co HARDMETAL

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ABSTRACT

This paper describes the preparation process and some properties of VC-WC-Co alloys containing approximately 10 wt% VC and 10 wt% Co. The sinterability of the alloys proved to be better than expected and the hardness higher than the hardness of WC-Co alloys of equal cobalt content. The toughness was found to be superior to the toughness of WC-Co alloys of equal hardness.

1. INTRODUCTION

It was reported elsewhere^[1] that VC-WC-Co alloys had been prepared having higher hardness, abrasion resistance and erosion resistance but lower toughness than WC-Co alloys of equal cobalt content. It was also reported that the lower toughness was due to the brittleness of the VC grains, whose average size was not lower than 10 μm . Therefore, attempts have been made to produce the same material with a smaller mean VC grain size, so that cracks forming in VC grains would be much shorter than the critical crack size of the material. Hence effort has been directed towards producing finer grade powders and avoiding grain growth during sintering.

Finer VC-WC-Co grade powders were produced through prolonged milling via two routes^[2]: from a V_2O_5 starting powder, which was mixed with WC, carburized, and mixed with cobalt; and from a preformed V_8C_7 starting powder, which was mixed with WC and cobalt. In both cases the grade powder produced had mean grain size smaller than 2 μm . Grain growth in sintering was minimized by keeping the sintering temperature as low as possible.

The present paper describes the material produced so far, problems encountered in its production and some of its properties.

2. MATERIALS AND METHODS

The preparation of the two types of grade powder used to produce the samples discussed in this paper has been reported in detail elsewhere^[2]. The relevant properties of the two types of grade powder (Powder 1 and Powder 2) are given in Table I.

	Powder 1	Powder 2
Starting Powders	V_2O_5 , WC, C, Co	V_8C_7 , WC, Co
Approximate Composition* of the Grade Powder (wt%)	10%V, 10%Co, WC	10%VC, 10%Co, WC
Phases Present (from XRD)	VC, WC, (V, W)C	VC, WC, (V, W)C
Mean Particle Size	1.65 μm	1.28 μm

TABLE I. Characteristics of the VC-WC-Co Grade powders Used to Prepare the Samples. (* The composition is approximate because some (V,W)C was also formed, but its composition is not yet known.)