INVESTIGATION OF WC-CO HARDMETAL SURFACES PREPARED FOR BORIDING PROCESSES

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1. Introduction

Regarding to industrial performance, tools having higher hardnesses and toughness are those that will deliver better results and longer lifespan, what made hard metal tools widely used. Looking for enhancing this properties chemical vapor deposition (CVD) diamond coatings are quite promising candidates [1]. However the most used type of hard metal, tungsten carbide (WC-Co) tools, have Cobalt as binder metal, this element has catalyst function on the formation of graphite, and causes poor film adhesion during CVD diamond deposition process [2]. This promoves intense search for methods to mitigate or neutralize its negative influence, one of them is the formation of a blocking boride barrier through controlled reactions between boron and the constituent elements of the substrate, such as Carbon, Tungsten and the process main target, Cobalt, previously achieved by reactive thermodiffusion [3]. This work aims the development of a boriding process through activation by hot filament assisted chemical vapor deposition (HFCVD). Finally samples were analyzed by Energy-dispersive X-Ray Spectrometry (EDS) and X-Ray Diffraction (XRD).

2. Experimental

Tungsten carbide samples with 9% Cobalt metal binder were introduced into the reaction chamber and exposed to a pretreatment with reagent gas mixtures of H_2 and H_2 as carrier gas for a heated solution of Boron trioxide (B_2O_3) in methanol with or without CH_4 as Carbon source. Gas mixtures, time and sample temperature of process were as described in Table 1:

Sample	H_2 (sccm)	H_2+boron solution (sccm)	CH_4 (sccm)	Temperature (°C)	Time (h)
I	99	1	0	720	5
II	98	1	1	830	5

3. Results and Discussions

EDS and DRX spectra of Sample I and II were closely the same and shown high Cobalt concentration if compared to sample's starting 9%, as a consequence of the long time period exposed to high themperature, Cobalt present in deeper levels of the samples tended to migrate to surface, increasing considerably its concentration at this point and low Boron element concentration. Little or none Boron compound was identified by XRD, since its formation could be impaired by low concentration at final gas mixture or preferential reaction with other gas specimens, such as the Oxigen present in its own source molecule.

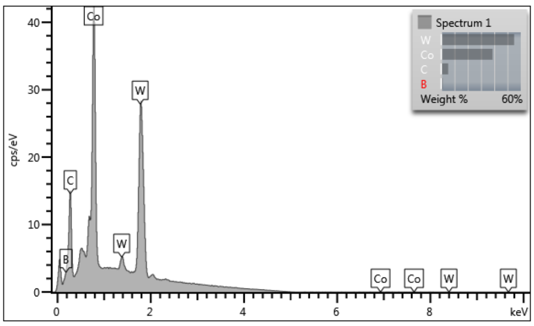

Fig. 1. *Sample I EDS spectra.*

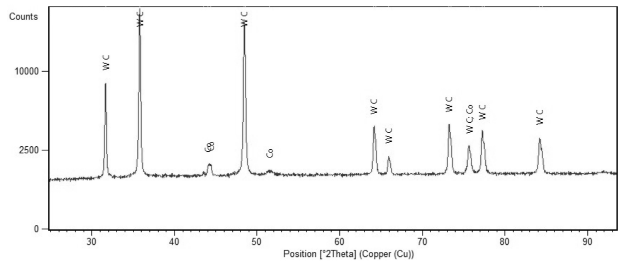

Fig. 2. *Sample I DRX Spectra.*

4. References (bold face Times New Roman 11 pt)

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[3] Campos, R. A., Contin, A., Trava-Airoldi, V. J., Barquete, D. M., Moro, J. R., and Corat, E. J. *"Influence of Boriding Process in Adhesion of CVD Diamond Films on Tungsten Carbide Substrates"*. Materials Research, 18(5),pp. 925-930, 2015

Acknowledgments

To FAPESP (processes number: 12/15857-1, 14/18139-8 and 13/25939-8) and CAPES for financial support.

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