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THE EFFECT OF THERMAL SHOCK ON THE ABRASIVE WEAR OF WC–12wt%Co

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A dissertation submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in fulfilment of the requirements for the degree of Master of Science in Engineering.

Johannesburg, 2007

DECLARATION

I declare that this dissertation is my own, unaided work. It is being submitted for the Degree of Master of Science in Engineering in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

_____

(Signature of candidate)

_____ day of _____ (year) _____

ABSTRACT

This work is a preliminary attempt to study the effect between thermal shock and abrasive wear in WC-Co alloys. This was done by evaluating the thermal shock resistance of a WC-12wt%Co mining grade as a function of temperature, number of thermal shock cycles and making comparisons between the abrasive wear responses of samples subjected to thermal shock and samples not subjected to thermal shock.

A furnace was designed for the thermal shock treatments. Abrasive wear tests were performed on a 2-body sliding wear apparatus using 80-grit SiC abrasive paper as a counter-face. Stereo and electron microscopy as well as microprobe techniques were used to analyse the effects of thermal shock. It is confirmed that thermal shock has a negative effect on the wear rate of WC-12wt%Co. The results showed an initial high mass loss rate during abrasive wear testing, which increased with increasing temperature and a decrease in wear rate with time until the wear rates converged for all samples. The surface analysis after thermal shock indicated voids on and below the surface, stained surfaces, a thin oxide layer and the possibility of WC decarburization which accelerated the wear response.

To

My son: Thabang Mochaki

My parents:Tlou Nelson Makgere and Maserole Josephine Makgere

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CONTENTS

THE EFFECT OF THERMAL SHOCK ON THE ABRASIVE WEAR OF WC-12wt%Co

DECLARATION…… i
ABSTRACT……iii
ACKNOWLEDGEMENTS……v
CONTENTS……vi
LIST OF FIGURES……ix
LIST OF TABLES……xvi

INTRODUCTION……...1

2. LITERATURE REVIEW…….....3
2.1 WC-Co sintered alloys……..3
2.1.1 Manufacture of WC-Co……..... 3
2.1.2 Properties of WC-Co……..... 5
2.1.2.1 Cobalt binder phase and mean free path……..... 5
2.1.2.2 Tungsten carbide…… 5
2.1.2.3 General properties……..... 6
2.1.2.4 Thermal properties of WC-Co alloys……..... 7
2.2 Abrasive wear of WC-Co alloys……. .9
2.3 Thermal shock……..... 13
2.3.1 Thermal stresses caused by thermal shock…….... 13
2.3.2 Repeated thermal shock of WC-Co alloys...…….... 16
2.4 Thermal shock fracture and wear……..…….…….……17
2.4.1 Failure mechanisms during rock drilling…….…… 18

2.4.2 Wear of WC-Co in rock drilling……. 19
2.5 Oxidation behaviour of WC-Co……... 20
2.5.1 Effect of cobalt content……... 21
2.5.2 Effect of temperature and oxygen…….. 21

3. EXPERIMENTAL PROCEDURE…… 25
3.1 Sample preparation…….. 25
3.2 Sample characterization……... 26
3.2.1 Vickers hardness……. 26
3.2.2 WC grain size and Co mean free path…… 27
3.2.3 Density ……...…… 27
3.3 Thermal shock tests……. 28
3.4 Abrasive wear tests…….. 32
3.5 Microscopic Analysis…….. 34
3.5.1 Stereo microscope…….. 34
3.5.2 Optical microscope……. 34
3.5.3 Scanning electron microscope ……... 34
3.5.4 Microprobe analysis……... 35

4. RESULTS AND DISCUSSIONS…….…… 38
4.1 Sample characterization……...…. 38
4.1.1 Vickers hardness……..... 39
4.1.2 WC grain size and Co mean free path……..... 39
4.1.3 Density…….… 41
4.2 Abrasive wear response…….… 41
4.2.1 Effect of thermal shock temperature on abrasive wear ……... 42
4.2.2 Effect of thermal shock cycles on abrasive wear…….. 44
4.2.3 Surface layer analysis……..... 45
4.2.4 SEM analysis of wear scars…… 51
4.3 Surface analysis…….……. 53
4.3.1 Surface analysis of samples subjected to thermal shock…..…… 53
4.3.1.1 Effect of thermal shock temperature……..... 53

4.3.1.2 Effect of Thermal shock cycles…….. 61
4.3.1.3 Surface Oxidation……..…. 67
4.3.1.4 Crack formation on the surface…….…….. 71
4.3.2 EDS Analysis ……. 73
4.3.2.1 Cobalt removal..... 74
4.3.2.2 White particles observed after thermal shock …….. 76
4.3.3 Analysis of cross-section ……..…… 81
4.3.3.1 Cobalt depletion……..... 81
4.3.3.2 Damaged edges after thermal shock……... 85
4.3.3.3 Microprobe analysis…… 89
4.4 Effect of immersing WC-12wt%Co in water…… 97

5. GENERAL DISCUSSION AND CONCLUSIONS……..... 100

5.1 Depleted Co on and below the surface……..... 102
5.2 Decarburization of WC…… 103
5.3 Oxidation of WC-12wt%Co…… 104
5.4 Calcium compound formation……. 105

APPENDIX A: Formulae to calculate the heat transfer in a solid material …….……. 106

APPENDIX B: Mass loss data from abrasion tests…..... 108

B1: Effect of thermal shock temperature on abrasive wear……... 108
B2: Effect of thermal shock cycles on abrasive wear…… 112

APPENDIX C: XRD data for sample subjected to 60 thermal shock cycles at 1000°C…….……. 115

REFERENCES…….…….. 118

LIST OF FIGURES

Figure		Page
2.1	Typical microstructure of WC-12wt%Co.	4
2.2	Schematic flow chart for manufacture WC-Co alloys [1].	4
2.3	Ternary diagram showing effect of composition on mechanical, chemical and thermal properties of cemented carbides [11].	7
2.4	Thermal conductivity of WC-Co hardmetals [1].	8
2.5	Thermal expansion coefficient of WC-Co hardmetals [1].	8
2.6	Graphs of abrasion resistance versus the cobalt content and mean free path [6].	11
2.7	Graph of abrasion resistance versus the hardness [6] .	12
2.8	Distribution of thermal stresses induced by thermal shock [24].	15
2.9	Maximum thermal stresses during thermal shock as a function of the heating temperature.[24].	15
2.10	The relationship between thermal stress resistance and thermal shock resistance [22].	16
2.11	Number of cracks per area with increasing number of thermal shocks [24].	17
2.12	Typical rock drill face embedded with WC-Co buttons [3]. 1	18
2.13	Schematic of a life limiting processes of drill buttons [3].	19
2.14	Weight gain per unit area vs. time graphs for 6% and 12%Co WC-Co samples [30].	21
2.15	Weight gain per unit area vs. time plots for WC-6%Co oxidized at 800°C [30].	22
2.16	XRD pattern from a WC-12wt%Co sample oxidized for 15 min at 800°C in $50O_2$/50Ar [30].	22
2.17	Effect of heating temperature on the oxidation of a sample of WC-6wt%Co.[30].	23

2.18	Schematic model of the oxidation of WC-Co alloys accompanied by swelling [33].	24
2.29	Swelling of WC-6wt%Co after exposure to oxidation at 700°C for 570 minutes [33].	24
3.1	Furnace used for heat treatment (heating and cooling rate).	28
3.2	Calibration of the furnace used.	29
3.3	Schematic of 2-body sliding wear apparatus used for abrasive wear tests.	33
3.4	Photograph of the 2-body sliding wear apparatus.	33
3.5	Micrograph showing two lines along which the sample was. scanned from the core towards the edge.	36
4.1	Microstructure of WC-12wt%Co.	38
4.2	WC grain size distribution of the WC-12wt%Co alloy.	40
4.3	Mean free path distribution of the WC-12wt%Co alloy.	40
4.4	Effect of thermal shock temperature at constant 60 thermal shock. cycles on the mass loss rate of WC-12wt%Co.	42
4.5	Effect of thermal shock temperature at 60 thermal shock cycles on the mass loss of WC-12wt%Co.	43
4.6	Effect of thermal shock cycles at constant thermal shock temperature of 800C on the mass loss rate of WC-12wt%Co.	44
4.7	Effect of thermal shock cycles at constant thermal shock temperature of 800C on the cumulative mass loss of WC-12wt%Co.	45
4.8	Effect of temperature and number of thermal shock cycles at the thickness of the layer removed after the initial ~7.2 seconds of abrasion.	47
4.9	Schematic representation of the thickness of material removed during wear.	49
4.10	SEM micrograph after abrasive wear of WC-12wt%Co without thermal shock.	51

4.11	SEM micrograph after abrasive wear of WC-12wt%Co after 60 thermal shock cycles at 600°C.	52
4.12	SEM micrograph after abrasive wear of WC-12wt%Co after 60 thermal shock cycles at 800°C.	52
4.13	Micrograph of WC-12wt%Co before thermal shock.	54
4.14	Micrograph of WC-12wt%Co after series of 60 cycles of thermal shock at 600°C.	54
4.15	Micrograph of WC-12wt%Co after 60 cycles of thermal shock at 800°C.	55
4.16	Micrograph of WC-12wt%Co after 60 cycles of thermal shock at 1000°C.	55
4.17	SEM micrographs near the edge of the sample subjected to thermal shock for 60 cycles at 600°C.	56
4.18	SEM micrographs of sample subjected to thermal shock for 60 cycles at 800°C.	57
4.19	SEM micrographs of sample subjected to thermal shock for 60 cycles at 800°C.	58
4.20	SEM micrographs of sample treated at 1000°C for 60 cycles	59
4.21	Micrograph of one of the areas of the sample treated at 1000°C for 60 cycles.	60
4.22	Micrograph of WC-12wt%Co after 60 thermal shock cycles at 800°C.	61
4.23	Micrograph of WC-12wt%Co after 80 thermal shock cycles at 800°C.	62
4.24	Micrograph of WC-12wt%Co after 100 thermal shock cycles at 800°C.	62
4.25	SEM micrographs (near the edge) of the WC-12wt%Co sample after being subjected to 80 cycles of thermal shock at 800°C.	63
4.26	SEM micrographs of sample treated at 800°C for 80 cycles.	64
4.27	SEM micrograph from near the edge of the surface of a WC-12wt%Co sample after being subjected to thermal shock at 800°C.	65

4.28 SEM micrograph showing white particles containing calcium observed in the middle of the sample. 65
4.29 SEM micrographs of sample treated at 800°C for 100 cycles near the edge. 66
4.30 EDS spectrum of a sample subjected to 60 cycles of thermal shock at 1000°C. 69
4.31 Shape change of a rectangular sample of WC-12wt%Co after 20 thermal shock cycles at 800°C of 5 minutes each. 70
4.32 Surface cracks on WC-12wt%Co after thermal shock. 72
4.33 Crack on the surface of a thermally shocked sample, with path parallel to the white line. 72
4.34 SEM micrograph of WC-12wt%Co without thermal shock with numbers on the grains. 73
4.35 EDS spectrum of spot 1 in Fig. 4.34 showing a high Co peak. 73
4.36 EDS spectrum of spot 4 with high W peak. 74
4.37 SEM micrograph of WC-12wt%Co after 60 thermal shock cycles at 1000°C. 75
4.38 EDS spectrum of spot 1. The spectrum shows a large amount of W in and around the voids with a low cobalt peak. 75
4.39 EDS spectrum of spot 2, the spectrum showed a large amount of Co at 600ºC. 76
4.40 SEM micrograph of WC-12wt%Co after 60 thermal shock cycles at 1000°C 77
4.41 EDS spectrum of spot 1, Ca, Co and W peaks are visible. The spectrum shows some oxide on the surface 77
4.42 EDS spectrum of sample after 60 cycles of thermal shocks at 600ºC. 78
4.43 EDS spectrum of sample after 60 cycles of thermal shocks at 800ºC. 79
4.44 EDS spectrum of sample after 80 cycles of thermal shocks at 800ºC. 79
4.45 EDS spectrum of sample after 100 cycles of thermal shocks

	at 800ºC	80
4.46	EDS spectrum of sample after 60 cycles of thermal shocks at 1000ºC.	80
4.47	SEM micrographs of a cross-section of WC-12wt%Co at the edge.	82
4.48	Same micrograph as in figure 4.47(c), showing square boxes where the area EDS spectrums were taken.	83
4.49	EDS spectrum of area A.	84
4.50	EDS spectrum of area B.	84
4.51	EDS spectrum of area C.	84
4.52	EDS spectrum of area D.	85
4.53	Cracks and rough surface on the edge of sample after 100 cycles of thermal shock at 800°C.	86
4.54	Crack along the edge of sample after 60 cycles of thermal shock at 1000°C.	86
4.55	Cracked WC grain after 80 cycles of thermal shock at 800°C.	87
4.56	Voids between the WC grains after 60 cycles of thermal shock at 800°C, near the edge.	87
4.57	Broken skeleton of WC grains after 60 cycles of thermal shock at 1000°C.	88
4.58	SEM micrograph of a cross-section after 60 cycles of thermal shock at 1000°C.	88
4.59	Micrograph of a cross-section showing two lines followed during the microprobe scans.	89
4.60	Line-scan of element in weight percent from sample without thermal shock.	90
4.61	Line-scans of element in atomic percent from sample without thermal shock.	91
4.62	Line-scans in element atomic percent after 60 cycles of thermal shock at 600°C.	92
4.63	Line-scans in element atomic percent after 60 cycles of thermal shock at 800°C.	93

4.64 Line-scans in element atomic percent after 80 cycles of thermal shock at 800°C. 94
4.65 Line-scans in element atomic percent after 100 cycles of thermal shock at 800°C. 95
4.66 Line-scans in element atomic percent after 60 cycles of thermal shock at 1000°C. 96
4.67 Surface appearance of WC-12wt%Co after being immersed in cold water for 12 hours. 98
4.68 Closer view of the surface of WC-12wt%Co immersed in cold water. 98
4.69 WC-12wt%Co alloy immersed in cold water, white particles were observed 99

5.1 Approximate calculations of the removed layer in mining where thermal shock and abrasive wear occur simultaneously. 101
5.2 Line-scan element atomic percent after 60 cycles of thermal shock at 600°C. 103
C1 XRD pattern for WC-12wt%Co after 60 thermal shock cycles at 1000°C. 115

LIST OF TABLES

Table **page**

2.1 Thermal properties of WC, Co and different WC-Co grades [3]. 9
2.2 Thermal and mechanical properties for WC and Co binder. that influences the thermal shock [24]. 13

3.1 Test conditions at constant thermal shock temperature of 800ºC. 31
3.2 Test conditions at constant thermal shock cycles (60 cycles). 31

4.1 Nominal properties of WC-12wt%Co from BOART LONGYEAR 39

4.2	Mean WC grain size and Co mean free path of WC-12wt%Co.	40
4.3	Density measurements of WC-12wt%Co alloy.	41
4.4	Mass loss and the thickness of layer removed during the initial ~7.2 seconds of abrasion, assuming the density of the lost mass to be 14.33g/cm^3.	46
4.5	Mass loss and thickness of removed layer after 180 sec	48
4.6	Mass loss at the time the curve of the heat treated samples converges with the curve of the non-heat treated samples and calculated affected layer	50
4.7	Mass loss of samples after thermal shock.	68
B1	Mass losses on samples of WC-12wt%Co without thermal shock.	110
B2	Mass losses after abrasive wear on samples subjected to 60 thermal shock cycles at 600°C.	111
B3	Mass losses after abrasive wear on samples subjected to 60 thermal shock cycles at 800°C.	112
B4	Mass losses after abrasive wear on samples subjected to 60 thermal shock cycles at 1000°C.	113
B5	Mass losses after abrasive wear on samples subjected to 60 thermal shock cycles at 800°C.	114
B6	Mass losses after abrasive wear on samples subjected to 80 thermal shock cycles at 800°C.	115
B7	Mass losses after abrasive wear on samples subjected to 100 thermal shock cycles at 800°C.	116
C2	Peak list of WC, reference code: 01-072-0097.	117
C3	Peak list of Co, reference code: 01-089-4308.	118
C4	Peak list of $CoWO_4$, reference code: 00-015-0867.	118
C5	Peak list of WO_3, reference code: 01-075-2072.	118