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EFFECT OF SiC ABRASIVE BREAKDOWN ON THE WEAR RATE OF WC-12WT%CO ALLOY

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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 research project is a preliminary investigation of the effect of SiC abrasive breakdown on the wear rate of a WC-12wt%Co mining alloy. Wear tests were carried out on a two body-sliding wear apparatus under (a) “Ideal” (replacing the SiC paper periodically to ensure continual exposure to fresh abrasives), (b) “No debris” (removing the wear debris periodically) and (c) “With debris” (retaining the wear debris for the entire wear test) wear conditions. The WC-12wt%Co specimens and SiC abrasive grits were examined before and after the wear tests using optical, stereo and electron microscopy.

As wear progressed, the SiC abrasives blunted thereby increasing the abrasive/specimen contact area, resulting in a reduction in the WC-12wt%Co wear rate. Wear debris clogging the interstices between the abrasive grits caused a further reduction in the WC-12wt%Co wear rate by adding to the abrasive/specimen contact area already created by blunting. Increasing the applied load resulted in an increase in the WC-12wt%Co wear rate under “Ideal” wear conditions. Under the remaining wear conditions, the increased load resulted in a faster deterioration of the SiC grits. The dominant wear mechanisms under all conditions are characterized by hard abrasive wear that caused extensive grooving, Co binder extrusion and cracking and fragmentation of WC grains

To

My grandmother: Nondindi Julia Plaatjie

My parents: Magaret Xoliswa Plaatjie and Linda Oscar Mabhali

My sisters: Zintle Plaatjie, Zimkhitha Plaatjie and Cebisa Mabhali

Plaatjie, Mabhali and Nzube families

For

Their love, support and patience

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