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The effect of thermal shock on the abrasive wear of WC-12wt%Co

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2009-03-25T10:08:31Z
http://hdl.handle.net/10539/6798

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1. INTRODUCTION

WC-Co alloys are known to have high hardness and strength and one of their important applications is in mining, where they are used as drill bit inserts and are subjected to thermal shock and abrasive wear during rock drilling [1].

Thermal shock is caused by the high temperature fluctuations generated during the drilling operation [2]. These temperature gradients are caused by flowing water (or other fluids) that is used to flush away the crushed rocks during drilling [2]. Currently there is no clarity on the service temperature of rock drilling buttons; temperatures of more than a 1000ºC may be reached depending on the rock type [3].

Few studies have been reported on abrasive wear of cemented carbides during rock drilling and thus far it has been reported that thermal shock generates surface cracking on the inserts [2]. However a study of the synergy between thermal shock and abrasive wear has seldom been reported. This study presents a preliminary attempt to understand the effect of thermal shock on the abrasive wear of hardmetals during rock drilling.

This investigation focused on the abrasive wear response of WC-12wt%Co samples subjected to thermal shock under different thermal shock conditions and samples not subjected to thermal shock. The samples were subjected to two types of thermal shock treatment:

(1) Keeping the temperature constant while varying the number of thermal shock cycles;

(2) Keeping the number of thermal shock cycles constant while varying the thermal shock temperature.

The treated samples were then examined and tested for abrasive wear. Their abrasive wear behavior was compared to those that had not been exposed to thermal shock.

In this project, Chapter 2 reviews studies on the properties, effect of thermal shock on cemented carbides and on surface cracks observed during rock drilling as a result of thermal shock including the oxidation behaviour of WC-Co. Chapter 3 describes the thermal shock and abrasive wear conditions and techniques used. In Chapter 4 the results and discussion are presented followed by Chapter 5 where the general discussion and the conclusions of the investigation are detailed.