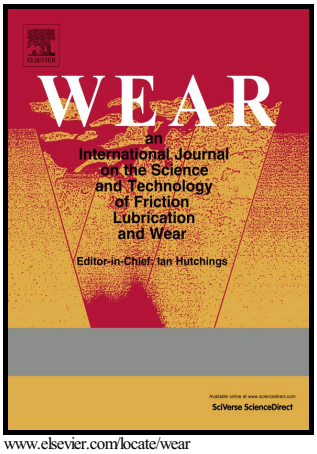
Effects of workpiece microstructure, mechanical properties and machining conditions on tool wear when milling compacted graphite iron

Amir Malakizadi, Rohollah Ghasemi, Carsten Behring, Jakob Olofsson, Anders E.W. Jarfors, Lars Nyborg, Peter Krajnik



www.elsevier.com/locate/wear

PII: S0043-1648(18)30614-8
DOI: https://doi.org/10.1016/j.wear.2018.07.005
Reference: WEA102453

To appear in: *Wear*

Received date: 23 May 2018
Revised date: 9 July 2018
Accepted date: 9 July 2018

Cite this article as: Amir Malakizadi, Rohollah Ghasemi, Carsten Behring, Jakob Olofsson, Anders E.W. Jarfors, Lars Nyborg and Peter Krajnik, Effects of workpiece microstructure, mechanical properties and machining conditions on tool wear when milling compacted graphite iron, *Wear,* https://doi.org/10.1016/j.wear.2018.07.005

Effects of workpiece microstructure, mechanical properties and machining conditions on tool wear when milling compacted graphite iron

Amir Malakizadi[1], Rohollah Ghasemi[2], Carsten Behring[1], Jakob Olofsson[2], Anders E. W. Jarfors[2], Lars Nyborg[1], Peter Krajnik[1]

[1]Chalmers University of Technology, Department of Industrial and Materials Science, Gothenburg, Sweden

[2] Jönköping University, School of Engineering, Department of Materials and Manufacturing, Jönköping, Sweden

Abstract

The aim of the present study was to investigate the tool performance when machining compacted graphite iron (CGI) alloys. A comparison was made between solid solution strengthened CGI including various amounts of silicon (Si-CGI) and the pearlitic-ferritic CGI as a reference material. The emphasis was on examining the influence of microstructure and mechanical properties of the material on tool wear in face milling process. Machining experiments were performed on the engine-like test pieces comprised of solid solution strengthened CGI with three different silicon contents and the reference CGI alloy. The results showed up-to 50% lower flank wear when machining Si-CGI alloys, although with comparable hardness and tensile properties. In-depth analysis of the worn tool surfaces showed that the abrasion and adhesion were the dominant wear mechanisms for all investigated alloys. However, the better tool performance when machining Si-CGI alloys was mainly due to a lower amount of abrasive carbo-nitride particles and the suppression of pearlite formation in the investigated solid solution strengthened alloys.

Keywords: Milling, Tool wear, CGI, Machinability, Solution hardening; casting