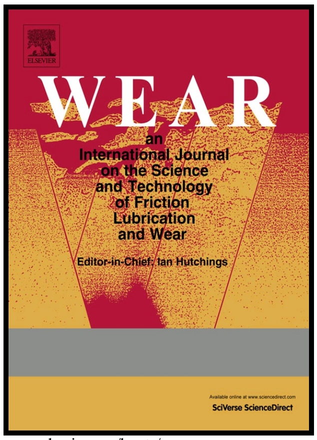
Author's Accepted Manuscript



www.elsevier.com/locate/wear

Influence of duplex ferritic-austenitic matrix on two body abrasive wear behaviour of high chromium white cast iron

P.S.M. Jena, J.K. Sahu, R.K. Rai, S.K. Das, R.K. Singh

PII: S0043-1648(17)31790-8
DOI: https://doi.org/10.1016/j.wear.2018.04.004
Reference: WEA102396

To appear in: *Wear*

Received date: 16 December 2017
Revised date: 5 April 2018
Accepted date: 5 April 2018

Cite this article as: P.S.M. Jena, J.K. Sahu, R.K. Rai, S.K. Das and R.K. Singh, Influence of duplex ferritic-austenitic matrix on two body abrasive wear behaviour of high chromium white cast iron, *Wear,* https://doi.org/10.1016/j.wear.2018.04.004

Influence of duplex ferritic-austenitic matrix on two body abrasive wear behaviour of high chromium white cast iron

P. S. M. Jena*, J. K. Sahu, R.K. Rai, S.K. Das, R K. Singh

MTE Division, CSIR-National Metallurgical Laboratory, Jamshedpur-831007, India
psmanoranjan@gmail.com

Abstract

Wear resistance of white cast iron is known to be sacrificed when it is attempted to enhance the impact toughness. In the present study, it is shown that a suitably engineered microstructure can retain/enhance the wear resistance between 2.5-3.5 times even when impact energy value is increased from 4 J/cm^2 to 13 J/cm^2. A novel microstructure is designed based on DICTRA®™ simulation and is validated after casting and subsequent cyclic annealing. The novelty of this microstructure is the presence of duplex ferritic-austenitic matrix and partially spherodized M_7C_3 carbides. The wear behaviour of the newly developed grades is compared with standard class-III high chromium white cast iron. The microstructure of the investigated alloys, the role of micro-constituents on the wear mechanism is extensively studied through scanning electron microscopic examination. The abrasive wear resisting mechanisms of the newly developed alloy are ascertained to be resistance to plastic flow leading to formation of humps and the formation of surface fatigue cracks.

Keywords: White cast iron; DICTRA®™; Wear; Impact; Duplex grain.

1. Introduction

Class-III high chromium white cast iron are used for manufacturing wear resistant components like kneader flights, slurry pumps, brick dies, where along with wear resistance, adequate impact toughness is also an essential requirement. The microstructure of class-III high chromium white cast iron (WCI) material consists of martainsitic, austenitic or ferritic matrix with eutectic M_7C_3 carbide and finely dispersed $M_{23}C_6$ carbide [1, 2]. Each phase constituent plays an important role in deciding the wear resistance and impact toughness of WCI. For example, martensite matrix shows highest wear resistance due to high hardness, whereas wear resistance of austenitic matrix is promising due to work hardening [3]. Ferritic matrix shows least wear resistance due to weak matrix carbide interfaces [3-5]. And several researchers have also discussed about the dependence of wear resistance of WCI on type and morphology of different carbides [1, 6]. For example, large size M_7C_3 carbides usually get fragmented and increase the depth of deformation of matrix from the wear surface and